



Final

**Parcel B Technical Memorandum in
Support of a Record of Decision
Amendment**

**Hunters Point Shipyard
San Francisco, California**

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APPENDIX E
BENEFICIAL USE EVALUATION FOR PARCEL B GROUNDWATER

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ACRONYMS AND ABBREVIATIONS

BCT	BRAC Cleanup Team
bgs	Below ground surface
BRAC	Base Realignment and Closure
DWR	Department of Water Resources
EPA	U.S. Environmental Protection Agency
FS	Feasibility study
gpd	Gallon per day
HPS	Hunters Point Shipyard
mg/L	Milligram per liter
PRC	PRC Environmental Management, Inc.
RI	Remedial investigation
SSF	Site-specific factor
SWRCB	California State Water Resources Control Board
TDS	Total dissolved solids
Tetra Tech	Tetra Tech EM Inc.
TMSRA	Technical memorandum in support of a record of decision amendment
Water Board	San Francisco Bay Regional Water Quality Control Board

E1.0 INTRODUCTION

This appendix presents an evaluation of beneficial uses for groundwater in the A- and B-aquifers at Parcel B at Hunters Point Shipyard (HPS). The results of the beneficial use evaluation were used to select potential exposure pathways for the human health risk assessment for Parcel B that is further discussed in Appendix A and in the main text of the technical memorandum in support of a record of decision amendment (TMSRA).

The hydrostratigraphic units at HPS include (1) the A-aquifer, (2) the aquitard, (3) the B-aquifer, and (4) the deep bedrock water-bearing zone. The A-aquifer at Parcel B consists mainly of unconsolidated Artificial Fill that overlies the aquitard and bedrock and forms a continuous zone of unconfined groundwater across the parcel. Alluvium and colluvium, Undifferentiated Upper Sand Deposits, and shallow bedrock also are part of the A-aquifer at various locations across Parcel B. The A-aquifer generally thickens from about 15 feet in the southwest to as much as 80 feet in the northeast, but averages about 25 feet thick over most of Parcel B.

The B-aquifer consists mainly of Undifferentiated Sedimentary Deposits that overlie bedrock or are contained within the Bay Mud Deposits at a few locations near the bay margin. The B-aquifer is not continuous across Parcel B but exists primarily in two separate areas: along the western boundary of the parcel, and in a portion of the central area of the parcel. The B-aquifer ranges in thickness from about 5 to 15 feet where it is present and averages 10 feet thick.

Bay Mud Deposits act as an aquitard that separates the A- and B-aquifers over most of the parcel, except for part of the western portion and some of the central portion, where the Bay Mud is absent and the A- and B-aquifers are adjacent. The Bay Mud Deposits generally thicken from where they pinch out against the historical shoreline in the southwest to 40 feet near the bay margin in the northeast.

The boundary between the A- and B-aquifers (the Bay Mud), although not present everywhere, separates the aquifers for the majority of Parcel B. The Navy and the regulatory agencies have agreed to use this designation of the aquifer system at Parcel B. The beneficial use evaluation presented in this appendix maintains this designation, even though the use of two separate aquifers may vary from the strict aquifer definitions presented in U.S. Environmental Protection Agency (EPA) guidance on groundwater beneficial use (EPA 1986).

This appendix contains four sections, including this introduction. Section E2.0 summarizes groundwater beneficial use evaluations for both the A- and B-aquifer groundwater, including both a comparison to federal and state groundwater classification criteria and an evaluation using site-specific factors (SSF) identified for HPS. Section E3.0 summarizes the evaluation of beneficial uses for groundwater at Parcel B. Section E4.0 includes references cited in this appendix. Figures and tables follow Section E4.0.

E2.0 EVALUATION OF GROUNDWATER BENEFICIAL USES

According to the Basin Plan for the San Francisco Bay, prepared by the San Francisco Bay Regional Water Quality Control Board (Water Board), groundwater at Parcel B has the following potential beneficial uses (Water Board 2000, 2006):

1. Agricultural supply
2. Industrial service and process supply
3. Municipal and domestic drinking water supply

The potential for A- and B-aquifer groundwater at Parcel B to be used for the first three beneficial uses identified above is evaluated in the following paragraphs. The remainder of this appendix describes the evaluation of the potential for groundwater in the A- and B-aquifers to be used for municipal and domestic drinking water supply.

Agricultural and Industrial Uses. Groundwater at Parcel B has not been used for agricultural or industrial purposes in the past. It is unlikely to be developed for these uses in the future because of limited potential for water production; existing institutional controls on well construction in San Francisco; and generally high total dissolved solids (TDS), chloride, salinity, specific conductance, and hardness values. Furthermore, use of Parcel B groundwater for industrial or agricultural purposes is not part of the City of San Francisco's redevelopment plan (San Francisco Redevelopment Agency 1997).

E2.1 PREVIOUS BENEFICIAL USE EVALUATIONS

Potential beneficial uses of groundwater at Parcel B have been addressed in previous documents; the following documents provide the primary record of groundwater-related information for Parcel B:

- Parcel B remedial investigation (RI) report, June 1996 (PRC Environmental Management, Inc. [PRC] and others 1996)
- Parcel B feasibility study (FS) report, November 1996 (PRC 1996)
- Twenty-nine quarterly groundwater sampling reports (various authors: refer to Table 2-1 of the main text of the TMSRA)
- Technical memorandum on the distribution of the Bay Mud Aquitard and characterization of the B-Aquifer at Parcel B, February 2001 (Tetra Tech EM Inc. [Tetra Tech] 2001a)

- Technical memorandum on Parcel B groundwater evaluation, November 2001 (Tetra Tech 2001b)
- August 11, 2003, letter from the Navy to the Water Board requesting exemption of the A-aquifer groundwater as a potential source of drinking water (U.S. Department of the Navy 2003)

Parcel B RI and FS reports. The RI and FS reports concluded that A- and B-aquifer groundwater underlying Parcel B has a beneficial use only as a source of surface water recharge to San Francisco Bay.

Quarterly sampling reports and technical memoranda. These technical documents present and interpret groundwater data but do not discuss potential beneficial uses of groundwater.

August 2003 letter to Water Board. In a letter to the Water Board dated August 11, 2003, the Navy presented an additional evaluation and emphasized that the A-aquifer is not reasonably expected to supply a public water system because of high TDS in much of the A-aquifer; the widespread presence of naturally occurring contaminants in the A-aquifer that cannot be reasonably treated; the presence of storm drain and sanitary sewer lines located beneath the water table that restrict locations where new water wells could be sited; the potential for saltwater intrusion should municipal or domestic water supply be attempted; and the existence of a high-quality public water supply system that is in place and operating.

In a letter to the Navy dated September 2003, the Water Board stated that it does not consider the A-aquifer at HPS a potential source of drinking water (Water Board 2003). Although the 2003 letter from the Water Board exempted the A-aquifer from being considered as a drinking water aquifer, EPA did not concur on this exemption. The beneficial use evaluation in this appendix is intended to assess use of the A-aquifer as a potential drinking water supply aquifer according to federal criteria and a set of SSFs proposed for consideration by EPA and the HPS Base Realignment and Closure (BRAC) Cleanup Team (BCT). The use of the B-aquifer is assessed a potential drinking water supply aquifer using both the state and federal criteria and the same SSFs.

E2.2 A-AQUIFER EVALUATION

This section presents federal and state groundwater classification criteria and evaluates the A-aquifer against the federal criteria and SSFs.

E2.2.1 Federal Groundwater Classification Criteria

Federal groundwater classification criteria identify three classes of groundwater (EPA 1986). Class I groundwater is an irreplaceable source of drinking water or is ecologically vital. Class II groundwater is a current source (Class IIA) or potential source (Class IIB) of drinking water that has other beneficial uses. Class III groundwater is not a potential source of drinking water and is

of limited beneficial use. EPA considers groundwater to be Class I or Class II if the following criteria are met:

- The TDS concentration is less than 10,000 milligrams per liter (mg/L)
- A minimum well yield of 150 gallons per day (gpd) or 0.1 gallon per minute is achievable

The average TDS concentration for groundwater in the A-aquifer in Parcel B is about 9,800 mg/L. Table E-1 presents the statistical results and methods that support this value. Figure E-1 presents the spatial analysis of maximum TDS concentrations for the A-aquifer in Parcel B. Figure E-1 also includes wells located at Parcel C near Building 134 that provide more continuous spatial coverage for the western section of Parcel B. However, the statistical analysis includes only Parcel B wells and none of the wells at Parcel C. As indicated on the figure, concentrations of TDS in most of the A-aquifer at Parcel B are less than 10,000 mg/L. The arithmetic mean and spatial distribution of TDS concentrations indicate that the A-aquifer does not exceed the federal TDS criterion of 10,000 mg/L (although the average TDS concentration is close to the criterion). Based on these statistical and spatial analyses, much of the A-aquifer groundwater at Parcel B has the potential for development as a source of drinking water.

Based on results of aquifer tests for wells IR06MW30A, IR10MW13A1, and IR18MW21A (PRC and others 1996), a well in the A-aquifer could provide a sustainable yield that would meet the federal criterion of 150 gpd.

Based on EPA groundwater classification guidance (EPA 1986), groundwater from the A-aquifer is designated as a potential source of drinking water (Class IIB) because TDS concentrations are less than 10,000 mg/L and well yield is likely greater than 150 gpd.

Groundwater in the A-aquifer does not qualify as Class I for the following reasons:

1. Groundwater in the A-aquifer is not “ecologically vital groundwater” nor does it supply a “sensitive ecological system supporting a unique habitat” at Parcel B. No listed or proposed endangered or threatened species exist at Parcel B in upland areas or along the shoreline; therefore, the A-aquifer groundwater cannot be considered ecologically vital.
2. Groundwater in the A-aquifer is not an irreplaceable source of drinking water to a substantial population. No public water systems that use groundwater or private supply wells are known within 2 miles from HPS. A substantial population (2,500 people according to EPA guidance) is not served by groundwater on or near HPS.
3. In general, the guidance describes Class I groundwater as “It is expected that Class I decisions will be small in number. Such ground waters will generally receive extraordinary protection due to the potential risk to large numbers of citizens dependent upon a source of drinking water...” No one depends on groundwater at or near HPS.

A Class I determination is not supported by the existing knowledge of the aquifers at HPS.

E2.2.2 State Groundwater Classification Criteria

Under California State Water Resources Control Board (SWRCB) Resolution 88-63, all groundwater is considered potentially suitable for municipal or domestic supply unless at least one of the following conditions applies:

1. The TDS concentration exceeds 3,000 mg/L and groundwater is not reasonably expected by regional Water Boards to supply a public water system;
2. The groundwater is contaminated, either by natural processes or by human activity, to the degree that it cannot reasonably be treated for domestic use; and
3. The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gpd (SWRCB 1988).

The Water Board has already issued a letter stating that the A-aquifer at HPS is not considered a potential source of drinking water (Water Board 2003); therefore, the evaluation for the A-aquifer does not include comparison with state criteria. The B-aquifer groundwater evaluation does include comparison with the state criteria (see Sections E2.3.1 and E2.3.2).

E2.2.3 Site-Specific Factor Evaluation

The SSFs used in this evaluation were based on input from EPA detailed in a 1999 letter (EPA 1999, Enclosure 5) and from the HPS BCT. Based on this input, the following SSFs were considered: (1) aquifer thickness; (2) actual measured TDS levels; (3) actual groundwater yield; (4) proximity to saltwater and the potential for saltwater intrusion; (5) quality of underlying water-bearing units; (6) existence of institutional controls on well construction or aquifer use; (7) information on current and historical use of the aquifer at HPS or in the community surrounding HPS; and (8) depth to groundwater, which the BCT considered a relevant SSF because shallow aquifers are susceptible to contamination and may not be suitable sources of drinking water. The SSF related to cost of cleanup to federal drinking water standards was not considered because of the absence of quantitative data.

The methods for evaluating each SSF and a summary of each SSF evaluated are described in the following paragraphs. The overall results of the SSF evaluation are summarized in Section E2.2.3.9.

E2.2.3.1 Aquifer Thickness

According to guidelines provided by EPA, the SSF for aquifer thickness is intended to assess the size of the groundwater resource that may be classified as drinking water quality (EPA 1999). As illustrated on Figure E-1, groundwater beneath approximately 35 acres at Parcel B meets the

federal TDS criterion (less than 10,000 mg/L of TDS). As discussed in Section 2.2.4 of the TMSRA, the saturated thickness of the A-aquifer is about 25 feet in this area. Assuming an average porosity of 25 percent, these values translate to approximately 220 acre-feet of available water in the A-aquifer for all of Parcel B, which is a relatively small groundwater resource. Continuous pumping of any A-aquifer well at Parcel B will most likely induce saltwater intrusion because of the limited nature of this resource, which would further degrade the groundwater. Consequently, the A-aquifer at Parcel B is considered to have low potential for use as a source of drinking water, based on the SSF for aquifer thickness.

E2.2.3.2 TDS Levels

EPA recognizes that all groundwater with TDS concentrations below 10,000 mg/L is not of equal value as a potential drinking water resource (EPA 1999). Groundwater extracted from areas with high TDS concentrations would require treatment to meet drinking water quality objectives and would therefore have lower potential for use as a source of drinking water than groundwater with lower TDS concentrations.

A-aquifer groundwater extracted from areas with high TDS concentrations would require treatment to meet drinking water quality objectives. The statistical evaluation of TDS data indicated that the average TDS concentration in the A-aquifer at Parcel B is about 9,800 mg/L, which is relatively high for use as a source of drinking water. Although this average concentration is slightly below the federal TDS criterion, it is well above the state criterion of 3,000 mg/L. The actual TDS concentrations in A-aquifer monitoring wells at Parcel B indicate low potential for this aquifer to be used as a source of drinking water.

E2.2.3.3 Groundwater Yield

Based on the results of aquifer tests conducted for the A-aquifer, a well in the A-aquifer could provide a sustainable yield that would meet the federal criterion of 150 gpd.

Aquifer test results revealed pumping rates ranging from 1,080 gpd at well IR06MW30A to 3,744 gpd at well IR10MW13A1 and 23,040 gpd at well IR18MW21A (PRC and others 1996). These results indicate that the A-aquifer provides a sustainable yield that would meet the federal criterion of 150 gpd. Hydraulic conductivity values for the A-aquifer ranged from 2.86×10^{-4} to 1.12×10^{-1} centimeter per second (0.81 to 316 feet per day), which represent values typical for fine to coarse sand (Bouwer 1978) and also indicate that a well in the A-aquifer would provide a sustainable yield of 150 gpd.

Based on the SSF for groundwater yield, A-aquifer groundwater at Parcel B has high potential to be used as a future source of drinking water.

E2.2.3.4 *Proximity to Saltwater and the Potential for Saltwater Intrusion*

Figure E-1 shows a zone of transitional salinity in the A-aquifer groundwater within Parcel B. Low-salinity groundwater is present in the upland areas of Parcel B away from the shoreline, whereas higher-salinity groundwater originating from San Francisco Bay is present along the shoreline. Figure E-1 shows that TDS concentrations are equal to or greater than 10,000 mg/L along the shoreline and approximately 300 feet inland from the shoreline, and that farther inland, up to 750 feet from the shoreline, TDS concentrations are equal to or greater than 3,000 mg/L. These existing, large areas of saline groundwater exemplify the high potential for saltwater intrusion in Parcel B. On a small scale, zones of higher-salinity water are expected to be present in the transitional zone caused by incursion of saltwater from San Francisco Bay along utility corridors, behind dry dock walls, and along natural preferential flow paths. Based on proximity to saltwater and the potential for saltwater intrusion, groundwater in the A-aquifer at Parcel B has low potential to be used as a future source of drinking water.

E2.2.3.5 *Quality of Underlying Water-Bearing Units*

The water-bearing unit underlying the A-aquifer at Parcel B is the B-aquifer. TDS concentrations in the B-aquifer are likely much lower than federal or state TDS criteria and indicate that the B-aquifer contains high-quality groundwater. The quality of the underlying B-aquifer is discussed in detail in Section E2.3 of this appendix. Based on the quality of the underlying B-aquifer, groundwater in the A-aquifer at Parcel B has high potential to be used as a future source of drinking water.

E2.2.3.6 *Existence of Institutional Controls on Well Construction or Aquifer Use*

The City of San Francisco prohibits installation of domestic wells within city boundaries (Tetra Tech 1999). In addition, California well standards prohibit installation of domestic wells within 50 feet of a storm drain or sanitary sewer line (California Department of Water Resources [DWR] 1991). Storm drain and sanitary sewer lines are present throughout Parcel B. Although the Navy will remove these lines, the present condition is typical of the likely density of sewer lines that the city would install during redevelopment of HPS. As a result, installation of domestic wells would be prohibited in many portions of the A-aquifer at Parcel B. There is low potential for A-aquifer groundwater at HPS to be used as a source of drinking water based on the existence of local and state institutional controls that prohibit or severely restrict locations where new wells can be installed for drinking water supply.

E2.2.3.7 *Historical and Current Groundwater Use*

A-aquifer groundwater at HPS has never been and is not currently used as a source of drinking water (PRC 1996). San Francisco currently obtains and plans to continue to obtain its municipal water supply from the Hetch Hetchy watershed in the Sierra Nevada as a source of drinking water in the reasonably foreseeable future (Tetra Tech 1999). Based on historical and current use, groundwater in the A-aquifer at HPS has low potential to be used as a future source of drinking water.

The Water Board recently proposed to remove the drinking water beneficial use designation for several areas near HPS with similar operational history, geology, hydrogeology, and proximity to San Francisco Bay. In 1999, the Water Board proposed to amend the Basin Plan for the San Francisco Bay Region to remove drinking water as a beneficial use from the Downtown San Francisco Basin, which is located approximately 2 miles north of HPS (Water Board 2000). The Water Board stated that groundwater in the Downtown San Francisco Basin is not suitable for use as drinking water for the following reasons "... (1) fresh water recharge is limited by the high density of buildings and paved surfaces, (2) the major source of groundwater recharge is leaking sewer pipes, (3) historic industrial development and placement of artificial fill has resulted in widespread pollution not from a single episode or source, and (4) brackish groundwater [exists] along the Bay shoreline" (Water Board 2000). Information provided in the Parcel B RI report indicates that groundwater in the A-aquifer underlying Parcel B is also affected by these factors (PRC and others 1996). This information on the nearby Downtown San Francisco Basin provides additional evidence that the A-aquifer groundwater at Parcel B has low potential for use as a source of drinking water. However, although the Water Board had adopted this amendment in April 2000, the State Water Resources Control Board and the Office of Administrative Law had not yet approved this amendment to the Basin Plan when the TMSRA was prepared.

E2.2.3.8 *Depth to Groundwater*

Groundwater at shallow depths is generally vulnerable to contamination because attenuation mechanisms in the vadose zone may not effectively reduce contaminant concentrations in infiltrating water over short vertical distances. In addition, the DWR well standards outlined in Bulletins 74-81 and 74-90 require the space between the well casing and the wall of the borehole (the annular space) to be effectively sealed to prevent the annular space from becoming a preferential pathway for movement of contaminants from the surface to the aquifer (DWR 1981, 1991). An individual domestic well requires a minimum annular seal of at least 20 feet, and a community water supply well requires a minimum annular seal of at least 50 feet. For these reasons, most drinking water supply wells are screened across deeper lithologic intervals or below impermeable strata, if possible. At Parcel B, the maximum depth to groundwater is typically 12 feet below ground surface (bgs), and most groundwater is encountered at depths less than 10 feet bgs. Furthermore, the saturated thickness of the A-aquifer is only about 25 feet. It is unlikely that a well could be installed in the A-aquifer with the required 20-foot minimum well seal because of the shallow depth to groundwater and the thinness of the aquifer at Parcel B. Consequently, Parcel B is considered to have low potential for use as a source of drinking water based on the SSF of depth to groundwater.

E2.2.3.9 *Site-Specific Factors Conclusions*

The table below summarizes the results of the SSF evaluation for the A-aquifer. Because six of the eight SSFs indicate that the aquifer has low potential for use as a source of drinking water, the entire A-aquifer at Parcel B is considered to have low potential for use based on the SSFs.

Site-Specific Factors	Potential for Drinking Water Beneficial Use
Aquifer Thickness	Low
TDS Levels	Low
Groundwater Yield	High
Proximity to Salt Water and Salt Water Intrusion	Low
Quality of Underlying Water-Bearing Units	High
Existence of Institutional Controls on Well Construction or Aquifer Use	Low
Historic and Current Groundwater Use	Low
Depth to Groundwater	Low
Navy Recommendation for Overall Evaluation of SSFs for the A-aquifer	A-aquifer has Low Potential for Use as a Drinking Water Source

E2.3 B-AQUIFER EVALUATION

This section evaluates groundwater in the B-aquifer against federal and state groundwater classification criteria and SSFs.

E2.3.1 Federal and State Groundwater Classification Criteria

TDS data were not collected for the two B-aquifer wells at Parcel B. However, based on cation data collected from these wells, the TDS concentration in B-aquifer groundwater is likely below the state TDS criterion of 3,000 mg/L and the federal TDS criterion of 10,000 mg/L. An empirical relationship was established for groundwater in Parcel B by comparing concentrations of sodium with TDS values for samples of A-aquifer groundwater, as shown on Figure E-2. A sodium concentration of about 575 mg/L indicates a TDS concentration that is approximately 3,000 mg/L. The highest concentration of sodium measured in samples from the two B-aquifer wells is 69.8 mg/L, which indicates a TDS concentration less than 3,000 mg/L. Based on state and federal TDS criteria, B-aquifer groundwater has potential for use as a source of drinking water.

E2.3.2 Federal and State Groundwater Well Yield Criteria Evaluation

Limited data on well yield are available for the B-aquifer. Data were compiled from monitoring well data reported during purging and sampling for groundwater sampling events from July and October 2000 at monitoring wells IR18MW100B and IR18MW101B. The groundwater sampling records indicated the following:

- IR18MW100B: Well sustained a 1.0 gallon per minute purge rate for 30 minutes before it was pumped dry and recovered to its original level in 2 hours. Based on the recovery rate, this well is assumed able to support a sustainable yield of approximately 180 gpd.
- IR18MW101B: Based on a sustained purge rate of more than 1 gallon per minute for 45 minutes with minimal drawdown, this well is assumed able to support a sustainable yield well over 200 gpd.

Both monitoring wells could provide a sustainable yield that would meet the federal criterion of 150 gpd; however, only one of two could meet the state sustainable yield requirement of 200 gpd. Still, only a small data set is available to assess this factor. Based on state and federal criteria for sustainable yield, the B-aquifer groundwater has potential for use as a source of drinking water.

E2.3.3 Site-Specific Factor Evaluation

The eight SSFs described in Section E2.2.3 were also used to evaluate suitability of groundwater in the B-aquifer as drinking water. These SSFs are discussed below.

E2.3.3.1 Aquifer Thickness

As discussed in Section E2.2.3.1 of this appendix, the basis for this SSF is that an aquifer must have a minimum thickness and areal extent to be a practical and sustainable source of drinking water. As discussed in Section 2.2.4 of the TMSRA, the extent of the B-aquifer is limited at Parcel B. The B-aquifer is not continuous across Parcel B, but exists primarily in two separate areas: along the western parcel boundary, and in a portion of the central area of the parcel. The B-aquifer is present over an area of about 18 acres with an average thickness of 10 feet. This estimate is based on (1) geological logs of soil borings drilled at Parcel B and interpreted geological cross sections presented in Section 2.2.3 of the TMSRA; (2) the "Distribution of the Bay Mud Aquitard and Characterization of the B-aquifer in Parcel B Technical Memorandum" (Tetra Tech 2001a); and (3) the portion of the B-aquifer within about 300 feet inland from the shoreline not being usable for drinking water purposes because TDS concentrations exceed 10,000 mg/L in the overlying A-aquifer. Assuming an average porosity of 25 percent, these values translate to approximately 45 acre-feet of available water in the B-aquifer for all of Parcel B, which is a relatively small groundwater resource. Continuous pumping of any B-aquifer well at Parcel B will most likely induce saltwater intrusion because of the limited nature of this groundwater resource, which would further degrade the groundwater resource. Consequently, the B-aquifer at Parcel B is considered to have low potential for use as a source of drinking water, based on the SSF for aquifer thickness.

E2.3.3.2 *TDS Levels*

TDS data were not collected for the two B-aquifer wells at Parcel B. However, based on sodium concentration data collected from these wells, the TDS concentration in B-aquifer groundwater is below both the state TDS criterion of 3,000 mg/L and the federal criterion of 10,000 mg/L (see Section E3.1). Based on state and federal TDS criteria, the B-aquifer groundwater has high potential for use as a source of drinking water.

E2.3.3.3 *Groundwater Yield*

Available data on this factor are limited to the well purging records during sampling the two monitoring wells screened in the B-aquifer in Parcel B. Based on these data, both monitoring wells could provide a sustainable yield that would meet the federal criterion of 150 gpd. However, only one of the two could meet the state sustainable yield requirement of 200 gpd. Based on criteria for sustainable yield and the fact that both wells are not able to sustain 150 gpd, the B-aquifer groundwater has low potential for use as a source of drinking water.

E2.3.3.4 *Proximity to Saltwater and the Potential for Saltwater Intrusion*

Groundwater quality in drinking water wells is at risk if the wells are located close to areas where groundwater exhibits high salinity. Long-term groundwater extraction from wells in these areas could degrade water quality as nearby saltwater is drawn toward the production wells to replace the extracted groundwater. It is likely that long-term groundwater extraction would cause saltwater intrusion and ongoing degradation of the B-aquifer because much of Parcel B is located close to San Francisco Bay. In addition, long-term groundwater extraction from the B-aquifer could induce downward migration of groundwater in the overlying A-aquifer where much of the groundwater has a high TDS concentration. Based on the proximity of Parcel B to saltwater in the San Francisco Bay, there is low potential for the B-aquifer groundwater at HPS to be used as a source of drinking water.

E2.3.3.5 *Quality of Underlying Water-Bearing Units*

The water-bearing unit underlying the B-aquifer at Parcel B is the bedrock water-bearing zone. Based on salinity levels measured in wells at Installation Restoration Site 06 in Parcel C adjacent to Parcel B, the TDS concentration in the bedrock water-bearing zone does not exceed the state and federal TDS criteria. Therefore, based on this SSF, the B-aquifer has high potential for use as a source of drinking water.

E2.3.3.6 *Existence of Institutional Controls on Well Construction or Aquifer Use*

As discussed in Section E2.2.3.6, the City of San Francisco prohibits installation of domestic wells within city boundaries (Tetra Tech 1999). In addition, California well standards prohibit installation of domestic wells within 50 feet of a storm drain or sanitary sewer line (DWR 1991). Storm drain and sanitary sewer lines are present throughout Parcel B. Although the Navy will

remove these lines, the present condition is typical of the likely density of sewer lines that the city would install during redevelopment of HPS. As a result, installation of domestic wells would be prohibited in many portions of the B-aquifer at Parcel B. Based on local and state institutional controls that prohibit or severely restrict locations where new drinking water supply wells can be installed, there is low potential for B-aquifer groundwater at HPS to be used as a source of drinking water.

E2.3.3.7 *Historical and Current Groundwater Use*

Similar to the A-aquifer evaluated in Section E2.2.3.7, B-aquifer groundwater at HPS has never been and is not currently used as a source of drinking water (PRC 1996). The City of San Francisco currently obtains and plans to continue to obtain its municipal water supply from the Hetch Hetchy watershed in the Sierra Nevada as a source of drinking water in the reasonably foreseeable future. Based on the SSF for historical and current groundwater use, groundwater in the B-aquifer at HPS has low potential to be used as a source of drinking water.

E2.3.3.8 *Depth to Groundwater*

Similar to the A-aquifer evaluation in Section E2.2.3.8, minimum annular seal requirements apply to any potential wells installed in the B-aquifer. Assuming a minimum of 10 feet of well screen is necessary for a water supply well, a minimum aquifer thickness of 10 feet extending from 20 to 30 feet bgs is necessary to meet the DWR requirements for a single domestic use well. Depth to the water-bearing zones of the B-aquifer at Parcel B typically ranges from 25 to 45 feet bgs in the area with drinking water quality groundwater. This depth is sufficient to ensure a well seal of at least 20 feet; therefore, the B-aquifer has moderate potential for use as a source of drinking water based on this SSF.

E2.3.3.9 *Site-Specific Factors Conclusions*

The table below summarizes the results of the SSF evaluation for the B-aquifer.

Site-Specific Factor	Potential for Drinking Water Beneficial Use
Aquifer Thickness	Low
TDS Levels	High
Groundwater Yield	Low
Proximity to Salt Water and Salt Water Intrusion	Low
Quality of Underlying Water-Bearing Units	High
Existence of Institutional Controls on Well Construction or Aquifer Use	Low
Historic and Current Groundwater Use	Low
Depth to Groundwater	Moderate
Navy Recommendation for Overall Evaluation of SSFs for the B-aquifer	B-aquifer has Low Potential for Use as a Drinking Water Source

E3.0 SUMMARY FOR DRINKING WATER BENEFICIAL USE EVALUATION

This section summarizes the evaluation of beneficial use of drinking water for the A- and B-aquifers at Parcel B.

E3.1 A-AQUIFER

The Water Board has concluded that the A-aquifer at HPS is unsuitable as a potential source of drinking water (Water Board 2003). The A-aquifer at Parcel B is also considered unsuitable as a potential source of drinking water based on federal groundwater classification criteria and an evaluation of the SSFs identified in EPA's letter to the Navy (EPA 1999).

E3.2 B-AQUIFER

The B-aquifer is present as two laterally discontinuous areas at Parcel B over a total area of about 18 acres. Concentrations of sodium in groundwater samples collected from the two wells in the B-aquifer would indicate TDS levels were below state and federal criteria for TDS. Based on the TDS data alone, the B-aquifer at Parcel B would be considered suitable as a potential source of drinking water. However, results of the evaluation of SSFs, including (1) the City of San Francisco's prohibition on installing domestic wells and the proximity of sewer lines and storm drains, (2) the lack of current or historical use of the aquifer for water supply, (3) the limited size of this groundwater resource, and (4) the proximity of saltwater to the aquifer and the potential for saltwater intrusion if significant quantities of groundwater are withdrawn from the aquifer indicate that the B-aquifer is not suitable for use as a potential source of drinking water.

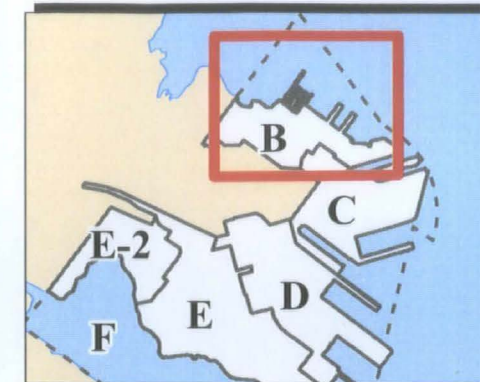
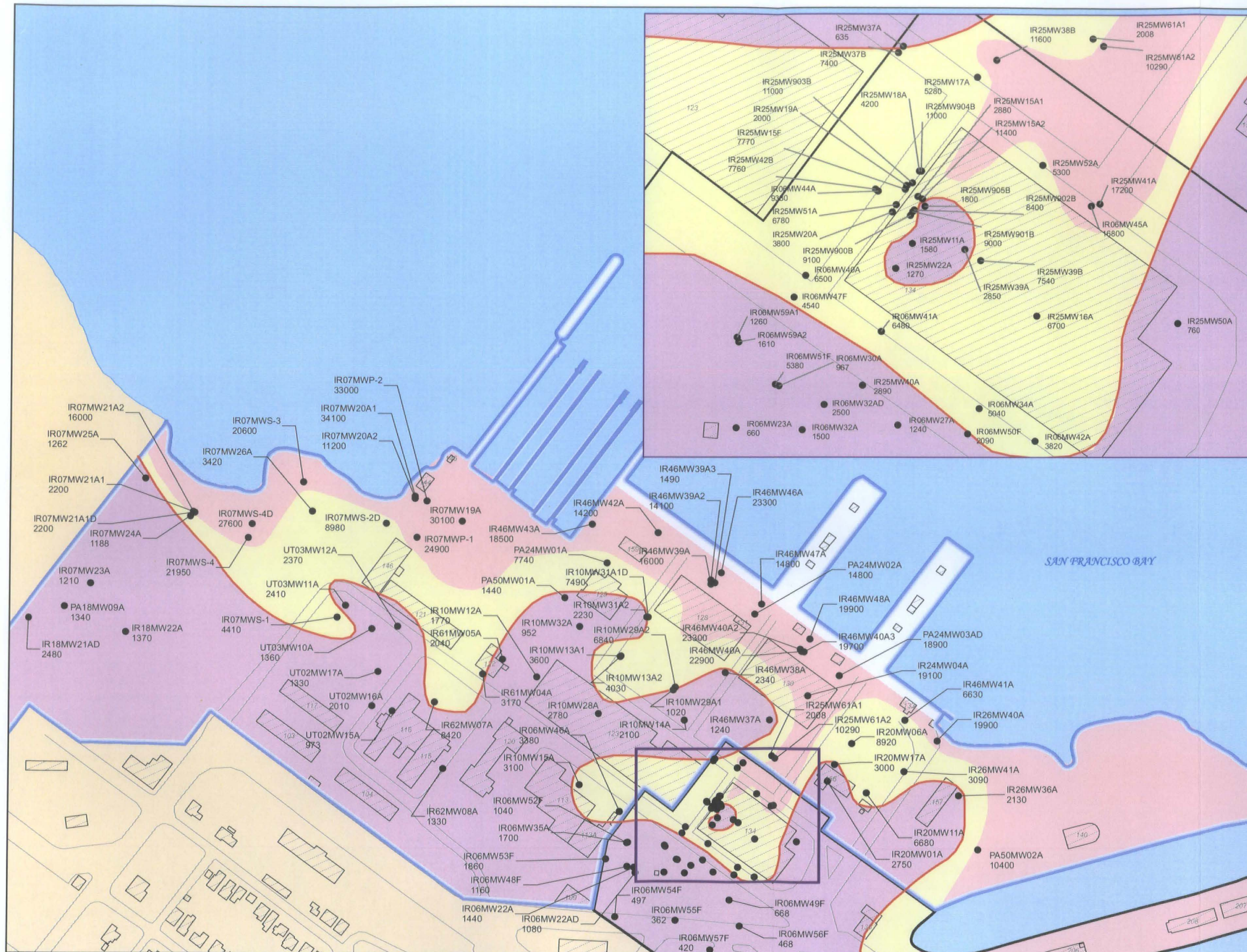
The evaluation of the B-aquifer suggests that it should not be considered a potential source of drinking water. However, the groundwater ingestion pathway is included in the human health risk assessment for the B-aquifer groundwater because of agreements made with the BCT on the human health risk assessment methodology (see Section 3.0 and Appendix A of the TMSRA). This assumption provides an additional measure of conservatism in the protection of human health at HPS.

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- EPA. 1998. Letter Regarding Differences between State of California and Federal EPA Definition of a Potential Drinking Water Source. From Mr. Tom Huetteman, EPA Region 9. To Mr. Hank Gee, Naval Facilities Engineering Command, Engineering Field Activity West. June 30.
- EPA. 1999. Letter Regarding Revised Federal Facility Agreement Schedules, which included an attachment describing the application of federal criteria for determining beneficial uses of groundwater. From Mr. Tom Huetteman, EPA Region 9. To Mr. Hank Gee, Naval Facilities Engineering Command, Engineering Field Activity West. May 12.

FIGURES



Location Map

- Monitoring Well with TDS Results (in mg/L)
- Estimated TDS Concentration Contour Line
- ▭ Parcel B Boundary
- ▭ Other Parcel Boundary
- ▭ Building
- Road

A-Aquifer TDS Zones

- ≥10,000 mg/L
- 3,000-10,000 mg/L
- <3,000 mg/L
- San Francisco Bay
- Non-Navy Property

Notes:

- ≥ Equal to or greater than
- < Less than
- IR Installation Restoration
- mg/L Milligram per liter
- TDS Total dissolved solids



0 300 600

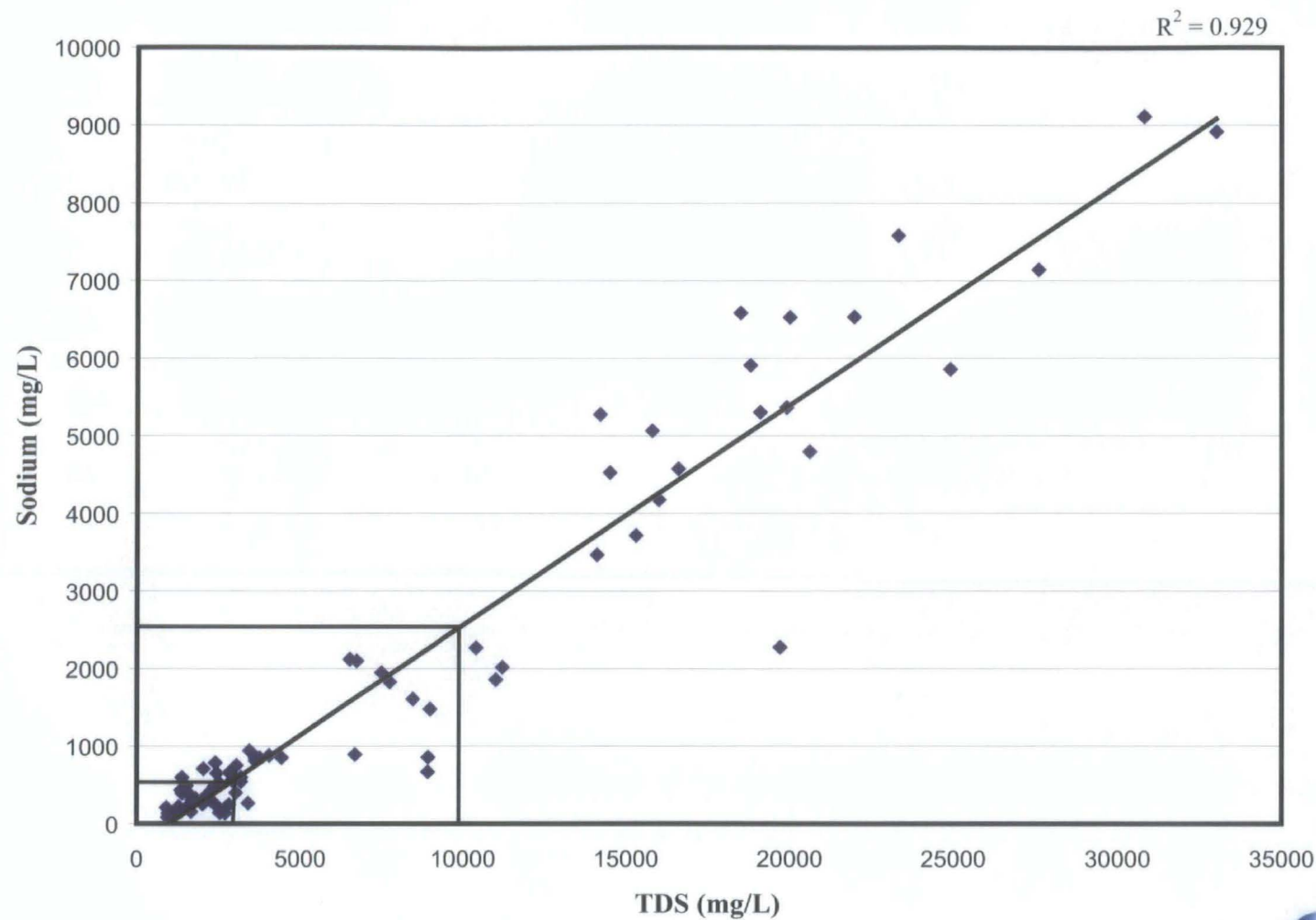
Scale in Feet



Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

**FIGURE E-1
MAXIMUM TOTAL DISSOLVED SOLIDS
IN THE A-AQUIFER**

TMSRA for Parcel B



Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE E-2
TOTAL DISSOLVED SOLIDS (TDS) VS.
SODIUM IN THE A-AQUIFER

TMSRA for Parcel B

TABLES

TABLE E-1: SUMMARY OF TOTAL DISSOLVED SOLIDS IN PARCEL B GROUNDWATER

Appendix E, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Parameter		Aquifer Zone A
Distribution ^a		Nonparametric
Number of Wells		71
Number of Measurements		168
Proportion of Measurements that Exceed 10,000 mg/kg (percent)		44
Arithmetic Mean (mg/kg)		9,793
Standard Deviation (mg/kg)		8,710
Coefficient of Variation (percent)		89
UCL ₉₅ (mg/kg) ^b		13,989
Median (mg/kg)		6,600
90th Percentile (mg/kg)		22,230
Minimum Reported Measurement	Result (mg/kg)	751
	Well	UT02MW15A
	Date	5/4/1995
Maximum Reported Measurement	Result (mg/kg)	34,100
	Well	IR07MW20A1
	Date	12/1/1987

Notes:

- a Tests for normal or lognormal distributions were based on the Shapiro-Wilk W test.
Tests for a gamma distribution were based on the Cramer-von-Mises W test.
All tests employed a Type I error rate of 0.05 (5 percent).
- b Calculations based on distribution-dependent formulae.
For Parcel B TDS, ProUCL recommended a UCL_{97.5} calculated using the nonparametric Chebyshev method (EPA 2004).

The number of measurements exceeds the number of wells because more than one measurement was made at some wells. The data set for this table includes all TDS data from all A-aquifer wells at Parcel B.

EPA U.S. Environmental Protection Agency
mg/kg Milligram per kilogram
TDS Total dissolved solids
UCL One-sided upper confidence limit on the mean

Reference:

EPA. 2004. "ProUCL Version 3.0 User Guide." Technical Support Center, Las Vegas, Nevada. April.

APPENDIX F
SEARCHABLE ANALYTICAL DATABASE (PROVIDE ON COMPACT DISK ONLY)

UNSCANNABLE MEDIA

To use the unscannable media document # 2259643
contact the Region IX Superfund Records Center

APPENDIX F
(1 OF 1)

APPENDIX G
CORRESPONDENCE AND GUIDANCE



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

June 30, 1998

Mr Henry Gee
BRAC Business Line Coordinator
Department of the Navy
Engineering Field Activity, West
900 Commodore Drive
San Bruno, California 94066-2402

Dear Mr. Gee:

The issue of groundwater classification has recently come up on many of our Bay Area bases, and I would like to take this opportunity to provide some clarification on the differences between the State of California's definition of a potential drinking water source and the federal EPA definition.

Under State Water Board resolution 88-63, all state waters are considered to be potential drinking water unless either the total dissolved solids (TDS) exceeds 3,000 mg/l and the Regional Water Board makes a determination that the water is not reasonably expected to supply a public water system, or the yield is less than 200 gal/day. However, EPA's Groundwater Classification Guidelines use a stricter standard of 10,000 mg/l TDS or less and a yield of 150 gal/day to define a potential drinking water source. The NCP Preamble directs EPA to use the Guidelines when determining the appropriate remediation for contaminated groundwater at CERCLA sites, and EPA's OSWER Direction # 9283.1-09 directs EPA to defer to the NCP Preamble and the Guidelines when a state does not have an EPA endorsed Comprehensive State Groundwater Protection Program (CSGWPP). EPA's definition is based on experiences around the country where the use of aquifers with a TDS up to 10,000 mg/l proved viable as a drinking water source. It also recognizes the importance of maintaining broad protections of potential drinking water sources in light of the growing demands on drinking water supplies. Please see the enclosures for related background information.

Since California does not have a CSGWPP, the federal definition of potential drinking water (10,000 ppm TDS or less and a yield of 150 gal/day) is used during the RI/FS. Many of the Navy's Bay sites overlie aquifers that meet the federal standard of a potential drinking water source and therefore the groundwater beneath these sites needs to be carried into the feasibility study for evaluation of remedial actions to meet potential source of drinking water cleanup goals. Likewise, drinking water Maximum Contaminant Levels (MCLs) are ARARs when an aquifer is a potential drinking water source. The feasibility study should look at a variety of remedial alternatives, which could also include natural attenuation, and, if necessary, the feasibility study

might also include the evaluation for a Technical Impracticability waiver of MCLs as ARARs.

I want to acknowledge that in a few past instances, EPA may have inappropriately concurred with determinations made by the State that an aquifer is not a potential source of drinking water, rather than applying the federal criteria. Unfortunately, in some cases, such as at Hunters Point, the application of federal criteria will require us to revisit some of the RI/FS work that has already been completed. I want to also apologize for the impacts that this may have on the process for making cleanup decisions, and let you know that we will work with you as much as possible and appropriate to minimize these impacts.

At each of the closing bases, EPA will work closely with the Navy to assist in the application of the federal criteria for determining potential drinking water sources. Thank you for your attention to this matter. We should discuss this further at our next monthly managers meeting, and please feel free to call me at (415) 744-2384 if you want to discuss this sooner.

Sincerely,



Tom Huetteman
Chief, Navy Section
Federal Facilities Cleanup Branch

Enclosure 1: NCP preamble, pages 8732-8735

Enclosure 2: OSWER Directive #9283.1-09

Enclosure 3: Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy, December 1986, Executive Summary

cc: Dan Murphy, DTSC
Dennis Mishek, RWQCB
Richard McMurtry, RWQCB

Enclosure 5
Application of Federal Criteria
for Determining Beneficial Uses of Groundwater for CERCLA Cleanups

In a letter to EPA-West dated June 30, 1998, EPA provided the Navy information about the document *Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy* (December 1986) and its use in CERCLA cleanups. This is an expansion on that information. It is intended to provide the Navy specific recommendations on how to evaluate groundwater using these guidelines in order to determine whether a contaminated aquifer or portion of an aquifer should be considered a potential drinking water source for the purposes of making CERCLA cleanup decisions.

the document Guidelines

An evaluation to determine whether an aquifer is a potential drinking water source should include the following:

Determine whether the yield criterion is met. EPA's yield criterion is 150 gals/day, and the State of California's yield criterion is 200 gals/day. Generally, most sites meet both the state and federal yield criterion. The Navy needs to provide a conclusion about this criterion using both the state and federal yield criteria.

Determine whether and where the Total Dissolved Solids (TDS) criterion is met. Maps should be provided that show where the TDS in the aquifer meets both the state (3,000 mg/l in California) and federal (10,000 mg/l) criteria, where it meets the federal criterion but not the state criterion, and where it does not meet either the state or federal criterion. For maps of the federal TDS criterion, the Navy may use the highest recorded TDS values for each well from their data set (the Navy should consult with the Water Board on which data points they need to see mapped). In addition to map(s), a table should be provided showing all of the available TDS data. Note, indirect measurements of TDS, such as electric conductivity, should not be used in this analysis.

Provide a hydrogeological profile of the site. The documentation should include a description of the site hydrogeology, including identification of each distinct water bearing unit at the site.

Determine the groundwater classification. Using the yield and TDS data, document the portions of the aquifer(s) that meet the federal criteria for a class II aquifer, and document the portions that meet the state criteria. Where a contaminated aquifer is potentially interconnected with an uncontaminated aquifer, the classification of the uncontaminated aquifer also needs to be determined for setting cleanup levels in the contaminated aquifer.

Determine what portions of the contaminated aquifer should be considered a potential drinking water source for a CERCLA cleanup. All waters that the state has determined are potential drinking water sources must be considered potential drinking water sources

for CERCLA cleanups unless the state makes a determination that an aquifer or part of an aquifer is not a potential drinking water source. Although not specifically discussed in EPA's Groundwater Classification Guidelines, the NCP, or the related OSWER Directive #9283.1-09, Region 9 believes that, in applying the federal groundwater classification criteria, other site specific factors can be considered in order to make a final determination as to whether all or portions of the aquifer(s) should be considered a potential drinking water source for making a CERCLA cleanup decision. The following is a list of factors that might be considered: the thickness of the aquifer (i.e., the size of the groundwater resource impacted), the actual TDS levels (are they closer to 10,000 mg/l or closer to 3,000 mg/l), the actual groundwater yield, the proximity to salt water and the potential for salt water intrusion, the quality of underlying water bearing units and whether these units are or are not current or potential drinking water sources, the existence of institutional controls on well construction or aquifer use, information, if any, on current and historic use of the aquifer on the base or in the community surrounding the base, and the cost of cleanup to MCLs. None of these factors by itself is necessarily justification for not being a potential drinking water source.

Tables summarizing groundwater contamination. Develop a groundwater screening table to determine where groundwater contamination is at acceptable concentrations for human health, regardless of whether it is a potential drinking water source, and where it is at potentially unacceptable concentrations. Groundwater data should be screened against MCLs, the tap water PRGs, and, where applicable, background.

Finally, as part of a proposed plan, the public should be given the chance to comment on decisions made about beneficial use of groundwater during the public comment period for a groundwater cleanup decision, and these comments need to be considered in making a final cleanup decision.

When the contaminated portion of an aquifer is determined to be a potential drinking water source, MCLs are ARARs for any CERCLA remedy selected for the aquifer. Where the Navy has made a determination that a contaminated aquifer, or portion of a contaminated aquifer, is not a potential drinking water source for its CERCLA cleanup decision, the Navy still needs to evaluate and address potential health threats from all other pathways, such as vapor phase migration to above ground or migration to surface waters, and all other potential beneficial uses, such as commercial, industrial, and agricultural. Consideration should also be given to the potential health threats that may result from unanticipated or even prohibited uses. For example, if the failure of a groundwater remedy that relies on institutional controls could result in a significant or even acute health threat, a more active remedy may be appropriate.

In those instances where a decision is made not to treat a class II aquifer as a potential drinking water source, the Navy should consider source control and mass removal as part of a remedy where there is the potential for substantial long term further degradation of the groundwater resource through the continued spread of contamination or where there is the potential for

significant health threats from unanticipated use of the groundwater. Such an approach involves a balance between overall protection of the groundwater resource, the Superfund policy to generally treat all class II aquifers as potential drinking water sources, and the necessary site specific requirements for a protective and cost-effective remedy. Region 9 is unwilling to support greater flexibility in the application of Superfund policy on the use of EPA's groundwater classification if such a balance is not met in the final cleanup decision. Therefore, EPA concurrence with any Navy determination that a class II aquifer should not be considered a potential drinking water source for a CERCLA cleanup decision will be contingent on the selected remedy and ultimate cleanup number.



ACQUISITION,
TECHNOLOGY
AND LOGISTICS

OFFICE OF THE UNDER SECRETARY OF DEFENSE

3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

JAN 16 2004

MEMORANDUM FOR DEPUTY ASSISTANT SECRETARY OF THE ARMY
(ENVIRONMENT, SAFETY, AND OCCUPATIONAL
HEALTH)
DEPUTY ASSISTANT SECRETARY OF THE NAVY
(ENVIRONMENT)
DEPUTY ASSISTANT SECRETARY OF THE AIR FORCE
(ENVIRONMENT, SAFETY, AND OCCUPATIONAL
HEALTH)
STAFF DIRECTOR, ENVIRONMENT AND SAFETY,
DEFENSE LOGISTICS AGENCY SUPPORT SERVICES

SUBJECT: Comprehensive Environmental Response, Compensation and Liability Act
(CERCLA) Record of Decision (ROD) and Post-ROD Policy

The Department of Defense (DoD) and the Environmental Protection Agency (EPA) have reached agreement on an interim two-prong approach for Records of Decision (RODs) and post-ROD implementation and documentation for National Priorities List (NPL) sites. My office fully supports both interim approaches. Components may choose either approach, or elements from each.

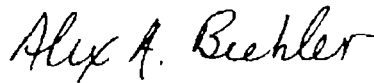
It is fully expected that regulators will not pressure any one Component to adopt a particular approach. If regulators seek to do so, or to diverge from either approach by adding requirements not encompassed within them, please report such deviations to my office.

My office, with input from Service representatives, has developed several metrics to evaluate the effectiveness of each approach. I realize that because each approach confers different requirements and agreements at different stages of the environmental restoration process, there is not a specific metric by which to fully evaluate each approach. As such, these metrics focus on multiple factors that will be viewed holistically. The two interim approaches are described at attachment 1 and the metrics are provided at attachment 2. Data should be accumulated beginning on October 1, 2003.



The Department recognizes that adopting these interim approaches requires revising some existing policies, especially those for Federal Facility Agreements (FFAs) and overall post-ROD policies for National Priorities List (NPL) sites. Interim guidance on these issues is provided at attachment 3.

The Department has also made a commitment to establish a priority post-ROD task force with the EPA to streamline and resolve issues regarding site and installation close-out requirements and to evaluate the best elements of both approaches. I encourage your support on this very important task. My point of contact is Ms. Patricia Ferrebee at (703) 695-6107.



Alex A. Beehler
Assistant Deputy Under Secretary of Defense
(Environment, Safety and Occupational Health)

Attachments:
As stated

**AIR FORCE
PRINCIPLES OF AGREEMENT FOR
PERFORMANCE-BASED RECORDS OF DECISION
IN ENVIRONMENTAL RESTORATION**

1. *The President's Management Agenda* clearly directs federal agencies to reform their activities to prioritize performance and results so that "emphasis on process will be replaced by a focus on results." Thus the focus of the Air Force's (AF) environmental restoration program is to select, implement, maintain, and where necessary review and monitor remedial action results that protect human health and the environment. EPA has joint responsibility with the AF to select the remedy at National Priority List (NPL) facilities, and an interest in confirming that such remedies remain in place and continue to be protective. The actions of both agencies should reflect the President's direction to restore freedom to manage to responsible agencies, eliminating excessive command and control, approval mechanisms and red tape that hinder efficiency.
2. Records of Decision (RODs) are public documents that should direct: (i) remedy implementation based on performance needed to achieve remedial objectives, (ii) notification and dialogue among parties, (iii) reasonable access to sites for performance verification, and (iv) accountability for performance on the part of the AF.
3. The AF has the responsibility and obligation to carry out the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and National Contingency Plan (NCP) requirements as it implements, maintains, and where necessary reviews and monitors protective remedies needed to achieve remedial objectives.
4. Restoration resources in the form of time, money and personnel should be focused on defining remedial objectives (i.e., results) and the essential actions required to achieve those objectives. Such objectives and essential actions are enforceable requirements of the ROD under CERCLA and the NCP.
 - a. The ROD should be streamlined to contain remedial objectives, essential implementation and maintenance actions to achieve the objectives, and other content elements required by CERCLA and the NCP. These performance objectives in the ROD, supported by the "essential actions" taken to meet them, are enforceable requirements of the remedy.
 - b. The Air Force must still determine the detailed steps to take to carry out actions that achieve remedial objectives. This can include, as appropriate, O&M plans or detailed implementation plans; the details of such documents will be shared with regulators for review and comment, but are not subject to additional EPA approval and enforcement beyond that applied to the ROD, subject to Section 8 below.

c. The ROD should not require new or further deliverables and documents, or contain repetitive information, and should use cross-references, existing data, templates, and remedy selection assumptions wherever it makes sense and is cost-effective to do so.

5. The Air Force will be held accountable to achieve the remedial objectives and essential actions identified in the ROD. This means being prepared for enforcement action should the Air Force fail to perform its essential responsibilities.

a. The Air Force remains subject to CERCLA enforcement mechanisms by EPA, states, and citizens if it fails to implement and maintain a protective remedy, such as, but not limited to, citizen suits, civil penalties, etc.

b. The Air Force remains subject to stipulated penalty provisions where existing Federal Facilities Agreements (FFAs) identify RODs as "primary documents."

6. The Air Force will agree to provide essential information to EPA, states and the public regarding the status of achieving performance objectives and essential actions identified in the ROD. EPA and states can independently verify such information through reasonable access to documents and facilities. Depending on site-specific risk factors that may warrant a change in reporting frequency, the expectation is that an annual summary report will be appropriate, supplemented by additional prompt reporting of any remedy deficiency or failure that presents or could imminently lead to an actual risk to human health and the environment, and the actions taken or planned to address and correct such deficiency or failure. Such limited monitoring and reporting, as described here, is an exception to the prohibition on post-ROD implementation measures reflected in the 23 Jan 2002 Air Force Policy and Guidance on Remedy Selection Documentation in Records of Decision (RODs).

7. Because "success" and "compliance" will be defined in terms of achieving performance objectives and essential actions, rather than meeting document exchange deadlines, Air Force personnel must foster and maintain dialogues with the regulators, particularly concerning technical implementation issues. Work plans or other technical documents that are not independently enforceable or subject to regulator approval should nonetheless undergo review by all parties to ensure compatibility with ultimate remedial objectives. The failure to do so will increase the likelihood of a legitimate challenge by the regulators and the public as to whether remedial action objectives in fact are being achieved (or have been achieved, if a closeout determination is at issue).

8. Integration of Performance-Based Response Actions with existing FFAs and RODs:

a. The process improvements developed as part of the Air Force performance-based principles do not change obligations under existing FFAs or RODs. However, parties to existing FFAs may amend them or interpret them to incorporate these performance-based actions and improvements.

b. If an existing FFA already addresses implementation, O&M plans, or completion and review provisions (e.g., identifies an O&M plan as a

"primary" document"), then such documents should conform to the enforceable objectives and actions contained in the ROD.

c. The Air Force should update the ROD as necessary to protect human health and the environment in conformance with Section 300.435 of the National Contingency Plan (i.e. perform a ROD amendment for fundamental changes, or an Explanation of Significant Difference (ESD) for significant changes, or record non-significant or minor changes in the post-ROD site file). If the Air Force finds that such an update is necessary, it should be done in accordance with the approach defined by these principles. In particular, if hazardous substances are left in place above unlimited use and unrestricted exposure levels, the 5-year review affords the Air Force an opportunity to confirm the conclusions in an existing ROD or to update the ROD if differences significantly or fundamentally alter the basic features of the selected remedy with respect to scope, performance or cost.

d. The Air Force shall incorporate these principles both in negotiating future Interagency Agreements and in modifying existing FFAs.

Attachment 2

Metrics

Objective: Measure the results of the two Post-ROD approaches being used in DoD.

Method: The best measure of any method is the end results achieved and at what cost. The following measures will allow DoD to determine the programmatic effects the Post-ROD approaches are having on key indicators of performance. In addition, a selected group of bases will be examined in detail to determine post-ROD procedures, practices and results. This information will also be useful for the DoD-EPA post-ROD task force.

Measures:

- Planned versus actual sites reaching RIP/RC in the current FY
- Reductions or increases in Cost-to-Complete for sites reaching RIP/RC in the current FY
 - Show reasons for any increases (e.g., new contamination; additional documents/approvals required by regulators)
- Report any violations of Land Use Controls (where DoD retains responsibility for the LUC) and reason for violation
- Examination of the following post-ROD elements at selected bases:
 - Procedures
 - Documents
 - Disputes
 - Results (site closures, de-listing)

Benefits:

- Uses two metrics already available
- Focuses on end results per the President's Management Agenda
- Adds an additional metric (LUC violations) but one that will show if LUC implementation actions are effective.
- Provides added qualitative assessment that can be used for benchmarking; avoids pitting services against one another; the best elements of each approach can be used by the services.

Attachment 3
DoD Policy for Federal Facility Agreements, Records of Decision, and Post-ROD Implementation and Documentation for National Priorities List (NPL) Sites

Federal Facility Agreement (FFA) Policy

The existing EPA-DoD model FFA language remains in effect, as amplified by the principles in Attachment 1, as described below. This includes the original 1988 model FFA, edits regarding state participation dated March 17, 1989, and DoD/EPA revisions dated February 10, 1999.

- *Direction on Signing Federal Facility Agreements* (April 23, 2001) and *Guidance on Land Use Control Agreements with Environmental Regulatory Agencies* (March 2, 2001) is amended to allow the addition of a document memorializing remedial action completion as a primary document as outlined in the Navy Principles.
- Other proposed FFA language that conflicts with the model FFA language must undergo a 72-hour review by DUSD(I&E) and the Components before being signed and are not binding precedent for other FFAs.

Record of Decision (ROD) Policy

- *Interim Guidance on Environmental Restoration Records of Decision* (June 4, 2002) is superseded to the extent it:
 - Prohibits the inclusion of periodic monitoring or visual inspection of use restrictions, and submission of associated reports (for information only) to regulators in RODs (such provisions may be included in RODs or an already defined primary document in accordance with the respective Navy or Air Force Principles); or
 - Requires inclusion of dispute resolution language in a ROD (as referenced in the final paragraph of the policy and attached thereto).

Post-ROD Implementation and Documentation Policy

- *Policy on Land Use Controls Associated with Environmental Restoration Activities* (January 17, 2001) remains in effect with the following changes:
 - Section 2, *Definition*: Components may use the following definition of land use controls in this section: "LUCs include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent or reduce risks to human health and the environment" or if following the Navy Principles, Components may use the definition used in the Navy Principles.
- *Guidance on Land Use Control Agreements with Environmental Regulatory Agencies* (March 2, 2001) remains in effect for voluntary agreements for implementation of LUCs. Where the guidance limits outlined provisions to voluntary agreement only as compared to enforceable documents, it is amended to allow inclusion of Land Use Control provisions listed in either the Navy or Air Force Principles in the manner described in those Principles.

**Memorandum of Agreement Between
The United States Department of the Navy and
The California Department of Toxic Substances Control**

Use of Model "Covenant to Restrict Use of Property" at Installations Being Closed and
Transferred by the United States Department of the Navy

1. Background

- a. The purpose of this Memorandum of Agreement (MOA) is to formalize the use of two model environmental restriction covenants (attached) that have been drafted during negotiations between representatives of the United States Department of the Navy (DON) and the California Department of Toxic Substances Control (DTSC).
- b. Under CERCLA Sec. 104, as delegated to DON by E.O. 12580, and implemented pursuant to the National Contingency Plan (NCP – 40 CFR Sec. 300 et seq.) and 10 USC Sec. 2701, et seq., the cleanup of hazardous substances, pollutants and contaminants is required to be at a level that protects human health and the environment. As a result, this protection can be achieved at certain sites by the imposition of "institutional controls" (i.e., ICs – legal mechanisms to protect human health and the environment by restricting access or exposure to the contaminants in question) with or without underlying "engineering controls" (i.e., ECs – engineered mechanisms such as a cap on a landfill, designed to physically insure access or exposure to the contaminants in question is prevented). Collectively these ICs and ECs are called "land use controls" (LUCs).
- c. In the case of property being closed and transferred by DON to a nonfederal entity, it is necessary to insure that these LUCs stay in place and are honored by all future owners and occupants of the property in question, for as long as contamination is present at levels that do not permit unrestricted use. One key way such LUCs can be maintained is by DON's retention of sufficient legal title and interest to insure continuing enforcement of the terms of the LUCs. This retention would entail burdening such conveyances of title with deed covenants insuring that the deed transferring such property contain a formal restriction – a restrictive covenant – on the use of the property that will "run with the land," and is enforceable against the "servient estate" (i.e., all future owners of the land) and is retained by the United States, as represented by DON, acting as holder of the "dominant estate." In addition, DON can convey a separate and similar restrictive covenant to DTSC as provided in

Section 2 below.

- d. In the State of California, such a restriction on the use of land, to protect human health and the environment is recognized by Section 1471 of the California Civil Code. This statute characterizes such a restrictive covenant as an "environmental restriction" and requires such words to be placed in the title of the document creating such an interest. DON has agreed to include such restrictive language in the deeds it executes where it imposes LUCs as a remedy under applicable law.
- e. Similar to CERCLA, State environmental protection laws recognize the availability of using LUCs as remedies to protect human health and the environment. Currently, DTSC's authority under Chapter 6.5 and 6.8 of Division 20 of the California Health and Safety Code, provides statutory avenues to impose LUCs at a cleanup site to insure that the LUCs are honored by future owners. Chapter 6.5 is generally used when the cleanup site in question is one subject to the State's authorities under the hazardous waste facilities law, and Chapter 6.8 is generally used when the cleanup site in question is one subject to the State's equivalent to the federal CERCLA program.
- f. In the case of property being closed and transferred to a nonfederal entity by DON where a cleanup remedy has used LUCs as a remedy as described above, DON and DTSC have a mutual interest in insuring that the "environmental restriction" imposed on the land is enforced for however long the protection of public health and the environment requires such restrictions.
- g. As a result, DON and DTSC agree that it is in both parties' and the public's interests, that DTSC be in a position to enforce the "environmental restrictions" that the DON will be imposing on these transferring parcels of property. To this end, in addition to retaining the power to enforce protective covenants, DON agrees to convey a separate power to enforce such restrictive covenants to DTSC equivalent to DON's power to enforce any "environmental restrictions" burdening the transferring property by entering into a "Covenant to Restrict Use of Property." Under both Chapter 6.5 and Chapter 6.8, DTSC has the authority to monitor and enforce such "environmental restrictions" conveyed to it by the owner of property on which such an "environmental restriction" has been found necessary. Therefore, in consideration of DON's conveying such an interest, DTSC may implement as appropriate the various statutory authorities it possesses under Chapter 6.5 and Chapter 6.8 (as applicable) to insure these "environmental restrictions" are honored by all future owners and occupants.


2. Terms of Understanding:

- a. DON and DTSC agree that in all future property transfers to a nonfederal agency, where DON is acting on behalf of the United States as the transferring or disposing agent, the applicable model "Covenant to Restrict Use of Property" attached to this MOU will be used throughout California when the proposed remedy involves imposing an IC (except those "early transfers" where 1) the transferee will perform the cleanup, and 2) the cleanup includes an IC in the remedy, and 3) has executed an order or enforceable agreement with DTSC or has entered into a Sec. 25222.1 agreement with DTSC, that calls for the transferee entering into a "Covenant to Restrict Use of Property" directly with DTSC).
- b. DON and DTSC have entered into a number of Federal Facility Agreements and Federal Site Remediation Agreements for DON property. These Agreements generally call for coordination of the DON's satisfaction of its corrective action obligations under the Resource Conservation and Recovery Act (RCRA) and Health and Safety Code section 25200.10 with its responsibilities under CERCLA section 120(i), EO 12580, the Defense Environmental Restoration Program and the NCP. The Agreements recognize that the DON may satisfy some or all of its corrective action obligations through CERCLA response actions. Where such corrective action at hazardous waste management units is being satisfied through CERCLA, Attachment A shall be used. Attachment B is the model which will be used for hazardous waste management facilities not addressed in Federal Site Remediation or Federal Facility Agreements.
- c. When issuing Proposed Plans for public comment, DON will attach a copy of this MOU and the appropriate model "Covenant to Restrict Use of Property" so as to assure the public that the specific LUC being proposed will be enforced, in part, by DON's retained power to enforce the deed covenants and conveyance of the power to enforce protective deed covenants to DTSC contemporaneously with the execution of the deed transferring DON's interests to the new owner.
- d. In using these models to draft the appropriate "Covenant to Restrict Use of Property," DON's and DTSC's personnel will work collaboratively to develop the specific information applicable to the given site called for by Articles I (Statement of Facts) and IV (Restrictions) of the attached models. A final "Covenant to Restrict Use of Property" that is ready for signature for a given site, will be prepared in time to allow it to be

executed contemporaneously with the execution of the deed transferring DON's non-retained interests in the property to the new owner. In the case of "early transfers" where DON is performing the cleanup after the transfer, and is imposing an LUC at the time of the "early transfer" in support of its ongoing cleanup activities, the Parties recognize that the contents of Articles I and IV of the model covenants for such sites will likely not be as detailed as that suggested in the attached models. The degree of detail contained within the model covenant will be the information available as to the cleanup site, although the covenants must be adequate to protect human health and the environment to allow an early transfer. The form of remedy and any additional associated IC will be more fully developed once the remedy is selected and implemented.

- e. The Parties recognize that given the need to tailor the terms of the "environmental restriction" to the remedy that is finally selected after seeking public comment on the Proposed Plan, the terms of the final "Covenant to Restrict Use of Property" may vary greatly from the draft proposal. The Parties recognize that the public should be given specific notice of this fact in the Proposed Plan.
- f. The Parties recognize that remedies proposed by the DON will be submitted to DTSC for concurrence. However, there may be unresolved disagreements at some cleanup sites concerning the remedy being proposed by DON including, in particular, the scope and nature of the LUCs, and the terms of any underlying, proposed "Covenant to Restrict Use of Property." In such situations the Parties will use their best efforts to resolve all disputes informally. If the Parties are ultimately unable to resolve the issue in dispute, DON and DTSC reserve any rights they might have to take any action available under applicable state or federal law.
- g. Either Party may terminate its involvement in this Agreement by giving thirty (30) days written notice to the other Party. Upon receipt of notice and the expiration of thirty days termination shall occur by operation of law.

Signed:



F.R. Ruehe
Rear Admiral
United States Navy
Commander Navy Region Southwest

10 MARCH 2000
Date

Signed:

Edwin F. Lowry

3/16/00

Edwin F. Lowry

Date

Director

Department of Toxic Substances Control

Attachment A: Model Site Mitigation Program "Environmental Restriction
Covenant and Agreement"

Attachment B: Model Hazardous Waste Management Program/State Regulated
Unit "Environmental Restriction Covenant and Agreement"

Approved as to form:

Date: 9 March 00

By: Mary Kay Tanyon

Approved as to form:

Date: March 16, 2000

By: Paul M. Thomas

MODEL SITE MITIGATION PROGRAM

DEED RESTRICTION

RECORDING REQUESTED BY:

[Covenantor's Name]

[Street Address]

[City], California [Zip Code]

WHEN RECORDED, MAIL TO:

Department of Toxic Substances Control

Region _____

[Street Address]

[City], California [Zip Code]

Attention: [Name of Branch Chief], Chief

[Branch Designation]

SPACE ABOVE THIS LINE RESERVED FOR RECORDER'S USE

COVENANT TO RESTRICT USE OF PROPERTY

ENVIRONMENTAL RESTRICTION

(Re: *[Insert parcel number(s) and name of site property to be restricted.]*)

This Covenant and Agreement ("Covenant") is made by and between the United States of America acting by and through the Department of the Navy ("DON") (the "Covenantor"), the current owner of property situated in [city], County of [], State of California, described in Exhibit "A", attached hereto and incorporated herein by this reference (the "Property"), and the State of California acting by and through the Department of Toxic Substances Control (the "Department"). Pursuant to Civil Code section 1471(c), Health and Safety Code Sections 25222.1 and 25355.5 the

ATTACHMENT A

Department has determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials as defined in Health and Safety Code ("H&SC") section 25260. In addition, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 (42 USC Section 9604), as delegated to the Covenantor by E.O. 12580, ratified by Congress in 10 USC Sec. 2701, et seq., and implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP – 40 CFR Part 300) and implementing guidances and policies, the Covenantor has also determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as the result of the presence on the land of hazardous substances, pollutants and contaminants as defined in CERCLA Section 101 (42 USC Section 9601).

The Covenantor and the Department, collectively referred to as the "Parties", therefore intend that the use of the Property be restricted as set forth in this Covenant, in order to protect human health, safety and the environment.

The Covenantor retains sufficient legal title and interest in the subject property to insure continuing enforcement of the protective covenants and agreements contained within this Covenant to Restrict the Use of Property. Further in any subsequent transfers or conveyance of title to nonfederal entities the DON shall burden the property with additional deed covenants that insure that any subsequent deed or transfer contains the protective covenants and right of access and power to conduct monitoring of wastes retained on site. Those covenants and agreements shall be enforceable against the servient estate in that those protective covenants shall run with the land to

all successors and assigns.

ARTICLE I

STATEMENT OF FACTS

1.01 The Property, totaling approximately [acres] [square yards] is more particularly described and depicted in Exhibit "A", attached hereto and incorporated herein by this reference. ***[Exhibit "A" must include the legal description of the property used by the county recorder. This must include the particular description of the boundaries of the area to be subject to a particular use restriction. If the property does not already have a legal description (it generally will not if it is a portion of a larger piece of property) a survey will be required.]*** The Property is located in the area now generally bounded by ***[include narrative description of the area; this will typically be street names: e.g., Main Street on the north, Maple Street on the east, etc.]*** County of [], State of California.

1.02 ***[Use this paragraph if imposing additional restrictions on a portion of the Property, for example on a capped portion, or if for any other reason it is necessary to precisely identify any portion of the property, such as an area with groundwater monitoring wells. The purpose of this paragraph is to give the precise location of such areas where use restrictions generally will apply.***

Renumber following paragraphs accordingly.] A limited portion of the Property is more particularly described in Exhibit "B" which is attached and incorporated by this reference ("Capped Property") as defined below ***[or "(other identified) Property"]***.

[Exhibit B must include a legal description of the exact area(s) being restricted

and any necessary diagram(s). This will generally require a legal survey and engineering drawing for the Cap or other area to be further restricted.] The [Capped (or other description)] Property is located in the area now generally bounded by []. **[Include language that generally describes the Capped or other identified Property.]** The [Capped (or other identified) Property] is also more specifically described as encompassing [] County Assessor's Parcel No.(s) [].

1.03 [Briefly describe the remedial measures implemented at the Property, including, if applicable, installation of a cap and construction and ongoing operation and maintenance of a groundwater treatment system, in order to identify the remaining contaminants and physical remedial measures on the Property that necessitate this deed restriction. This paragraph should also briefly discuss the regulatory context for the DON facility. Reference should be made to any applicable Federal Facility Agreement (FFA) or Federal Facility Site Remediation Agreement (FFSRA) and any corrective action obligations under RCRA or Chapter 6.5 of Division 20 of the Health and Safety Code covered by the FFA or FFSRA. This paragraph should refer to, and give the approval date for, the RAP, ROD, RAW or other decision document that selected the remedial measures at the Property and required this Covenant.]

SAMPLE [For a facility which has an FFA or FFSRA and hazardous waste management units]: The DON and the Department entered into a Federal Facility Agreement (FFA) on [date]. Pursuant to that FFA, the DON may satisfy some or all of its corrective action obligations under the Resource Conservation and Recovery Act

(RCRA)(42 USC 6901 et seq)or California Health and Safety Code section 25200.10 through CERCLA response actions. ***{Proceed to additional SAMPLES as appropriate.}***

SAMPLE [For a property with remaining contamination, but no cap, O&M, or other ongoing response activities]: The Property is [a portion of a site] being remediated pursuant to a Record of Decision (ROD) pursuant to the Defense Environmental Restoration Program (DERP), 10 U.S.C. section 2701 et seq, and CERCLA; and a Remedial Action Plan (RAP) pursuant to Chapter 6.8 of Division 20 of the H&SC, under the oversight of the Department. The ROD/RAP provides that a deed restriction be required as part of the site remediation, because lead, which is a hazardous substance, as defined in H&SC section 25316, and a hazardous material as defined in H&SC section 25260 remains at depths of 10 feet or more below the surface of the Property. The DON circulated the ROD/RAP, for public review and comment. The ROD/RAP was approved by the DON and concurred in by the Department on [date], pursuant to which the Property was excavated to a depth of 10 feet, graded, then backfilled with clean soil.

SAMPLE [For a property with ongoing operation and maintenance of a monitoring or treatment system and/or cap. The exact provisions of this paragraph will vary depending upon the facts of the particular site or facility. The paragraph below is illustrative of the kind of information that should be included. Note specifically there is reference to a signed Operation and Maintenance Agreement.]: [Covenantor] [or party responsible for the activity, if different from

Covenantor] is remediating the Property under the supervision and authority of the Department. The Property is [a portion of a site] being remediated pursuant to a Record of Decision (ROD) pursuant to the Defense Environmental Restoration Program (DERP), 10 U.S.C. section 2701 et seq; and a Remedial Action Plan (RAP) pursuant to Chapter 6.8 of Division 20 of the H&SC. Because hazardous substances, as defined in H&SC section 25316, which are also hazardous materials as defined in H&SC section 25260, including volatile organic compounds, total petroleum hydrocarbons, chlorinated benzenes and polychlorinated biphenyls, remain in the soil and groundwater in and under portions of the Property, the Remedial Action Plan provides that a deed restriction be required as part of the site remediation. The DON circulated the ROD/RAP for public review and comment. The ROD/RAP were approved by the DON and concurred in by Department on [date]. Remediation includes installing and maintaining a synthetic membrane cover ("Cap") over the Capped Property. The Cap consists of a low permeability synthetic membrane and other associated layers, as more particularly described in the engineering drawing attached as Exhibit "B" hereto. The response action also includes the installation and operation of: (1) a passive gas collection system on the Capped Property which removes volatile organic compounds migrating upward from under the Cap, (2) a vapor extraction system, which remediates certain volatile organic compound-impacted soils, and (3) groundwater monitoring wells ("Monitoring Wells"). The location of the gas collection system, vapor extraction system, and Monitoring Wells are shown on Exhibit "B". ***[This exhibit will have been identified in paragraph 1.02.]*** The operation and maintenance of the Cap, gas collection system, vapor extraction system, and Monitoring Wells is pursuant to an Operation and

Maintenance Manual incorporated into the Operation and Maintenance Agreement between [Covenantor] *[or name of other entity]* and the Department dated []. *[If an O&M Agreement has not been signed, the approval date for the O&M Manual or Plan should be referenced.]*

1.04 *[This paragraph should set out specific information about the risk assessment findings relevant to the contaminants of concern remaining at the property, essentially the basis for the restrictions imposed by this covenant. The Restrictions in Paragraphs 4.01, and any requirement for Soil Management Activity and any Prohibited Activity must be linked to the contaminants and risk assessment as discussed in this paragraph. The following paragraph is given for purposes of illustration. Each site will have different facts; those should be developed in a manner similar to the sample paragraph given here. Land use must be consistent with the approved RAW, RAP or ROD and the health risk assessment.]*

SAMPLE: As detailed in the Final Health Risk Assessment *[or other appropriate document]* as proposed by the Covenantor and approved by the Department on *[date]*, all or a portion of the surface and subsurface soils within 10 feet of the surface of the Property contain hazardous substances, as defined in H&SC section 25316, which include the following metal contaminants of concern in the ranges set forth below: arsenic (0.3 to 38.1 parts per million ("ppm"), beryllium (2.6 ppm), copper (4.6 to 756 ppm, and nickel (7.3-105 ppm). In addition, there are low pH soils. Based on the Final Risk Assessment the Department and the Covenantor have

concluded that use of the Property as a residence, hospital, school for persons under the age of 21 or day care center would entail an unacceptable cancer risk to the users or occupants of such property operated or occupied. The Department and the Covenantor have further concluded that the Property, as remediated, and operated or occupied subject to the restrictions of this Covenant, does not present an unacceptable threat to human safety or the environment, if limited to *[as applicable: commercial and industrial, parks, open space,[or other appropriate]]* use.

SAMPLE: [Note: Groundwater restrictions in Paragraph 3.04 must be based on a discussion of what contaminants are found in groundwater at the site, and what the drinking water standards are.]

Groundwater at the Property is found 15 to 20 feet below ground surface. Contaminants in the groundwater include benzene (50- 123 ppm), chromium (75- 213 ppm) and TCE (350-780 ppm). California drinking water standards are benzene at 0.08 ppm, chromium at 30 ppm and TCE at 5 ppm. The Department and the Covenantor concludes that the groundwater presents an unacceptable threat to human health and safety absent an environmental restriction to eliminate exposure to such levels of groundwater.

ARTICLE II

DEFINITIONS

2.01 Department. "Department" means the State of California by and through the Department of Toxic Substances Control and includes its successor agencies, if

any.

2.02 Owner. "Owner" shall include the Covenantor's successors in interest, and their successors in interest, including heirs and assigns, during his or her ownership of all or any portion of the Property.

2.03 Occupant. "Occupant" means Owners and any person or entity entitled by ownership, leasehold, or other legal relationship to the right to occupy any portion of the Property.

2.04 Covenantor. "Covenantor" shall mean the United States acting through the Department of the Navy (DON).

ARTICLE III

GENERAL PROVISIONS

3.01 Restrictions to Run with the Land. This Covenant sets forth protective provisions, covenants, restrictions, and conditions (collectively referred to as "Restrictions"), subject to which the Property and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are consistent with the separate restrictions placed in the deed by and in favor of the Covenantor, conveying the Property from the Covenantor to its successor in interest described above. Each and every Restriction:

(a) runs with the land in perpetuity pursuant to H&SC sections 25222.1, 25355.5(a)(1)(C) and Civil Code section 1471; (b) inures to the benefit of and passes with each and every portion of the Property; (c) shall apply to and bind all subsequent Occupants of the Property; (d) is for the benefit of, and is enforceable by the Department; and (e) is imposed upon the entire Property unless expressly stated as applicable only to a specific portion thereof.

3.02 Binding upon Owners/Occupants. Pursuant to H&SC sections 25222.1, 25355.5(a)(1)(C), this Covenant binds all Owners of the Property, their heirs, successors, and assignees, and the agents, employees, and lessees of the owners,

heirs, successors, and assignees. Pursuant to Civil Code section 1471(b), all successive owners of the Property are expressly bound hereby for the benefit of the Department.

3.03 Written Notice of Hazardous Substance Release. The Owner shall, prior to the sale, lease, or rental of the Property, give written notice to the subsequent transferee that a release of hazardous substances has come to be located on or beneath the Property, pursuant to Health and Safety Code section 25359.7. Such written notice shall include a copy of this Covenant. *[This last sentence is optional, to be used at sites where it is important that buyers and tenants be specifically aware of the ongoing remediation and their obligations.]*

3.04 Incorporation into Deeds and Leases. The Restrictions set forth herein shall be incorporated by reference in each and all deeds and leases for any portion of the Property.

3.05 Conveyance of Property. The Owner shall provide notice to the Department not later than thirty (30) days after any conveyance of any ownership interest in the Property (excluding mortgages, liens, and other non-possessory encumbrances). The Department shall not, by reason of this Covenant alone, have authority to approve, disapprove, or otherwise affect a conveyance, except as otherwise provided by law, by administrative order, or by a specific provision of this Covenant.

ARTICLE IV

RESTRICTIONS

[The following examples are intended to be illustrative. Not all of them will be

applicable. The restrictions for a particular property should have a direct relationship to what the Health Risk Assessment said was appropriate for use at the site. The restrictions must also protect the integrity and physical accessibility of, and legal rights of access to, any ongoing remediation facilities at the site.]

4.01 Prohibited Uses. The Property shall not be used for any of the following purposes: ***[Note: These prohibitions must be based on the appropriate decision documents as set forth in Paragraphs 1.03 and 1.04]***

[Sample provisions:]

- (a) A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation.
- (b) A hospital for humans.
- (c) A public or private school for persons under 21 years of age.
- (d) A day care center for children.

4.02. Soil Management ***[Note: The basis for the soil restrictions must be in Paragraphs 1.03 and 1.04]***

[Sample provisions]

- (a) No activities that will disturb the soil [at or below [] feet below grade] (e.g., excavation, grading, removal, trenching, filling, earth movement or mining) shall be allowed on the Property without a Soil Management Plan and a Health and Safety Plan approved by the Department.
- (b) Any contaminated soils brought to the surface by grading, excavation, trenching or backfilling shall be managed in accordance with all applicable provisions of

state and federal law.

(c) The Owner shall provide the Department written notice at least fourteen (14) days prior to any building, filling, grading, mining or excavating in the Property [more than [] feet below the soil surface] [which will remove more than [] cubic yards of soil].

4.03 Prohibited Activities. *[This paragraph will not be applicable to all sites. If not used, renumber accordingly. If there are groundwater restrictions, the basis must be in Paragraphs 1.03 and 1.04]* The following activities shall not be conducted at the Property:

[Sample provisions]

(a) Raising of food (agricultural products intended for human consumption or use, including but not limited to food, cattle, fibers, including cotton).

(b) Drilling for [drinking irrigation] water, oil, or gas [without prior written approval by the Department].

[or] (b) Extraction of groundwater for purposes other than site remediation or construction dewatering.

[The following paragraphs are samples of restrictions that may be applicable when there is a cap, vapor and/or gas collection system, and/or groundwater monitoring system.]

4.04 Non-Interference with Cap [and Vapor Extraction System (VES)] and [Groundwater Capture System (GCS)].

[Sample provisions:]

(a) Activities that may disturb the Cap (e.g. excavation, grading, removal, trenching, filling, earth movement, or mining) shall not be permitted on or within _____ feet of the Capped Property without prior review and approval by the Department. *[Similar restrictions may be appropriate for other ongoing remediation systems.]*

(b) All uses and development of the Capped Property shall preserve the integrity [*(if appropriate:)* and physical accessibility] of the Cap. *[Extend to other systems as appropriate.]*

(c) The Cap shall not be altered without written approval by the Department.

(d) The Owner shall notify the Department of each of the following: (i) the type, cause, location and date of any damage to the Cap and (ii) the type and date of repair of such damage. Notification to the Department shall be made as provided below within ten (10) working days of both the discovery of any such disturbance and the completion of any repairs. Timely and accurate notification by any Owner or Occupant shall satisfy this requirement on behalf of all other Owners and Occupants. *[Extend to other systems as appropriate.]*

4.05 Access for Department. The Department shall have reasonable right of entry and access to the Property for inspection, monitoring, and other activities consistent with the purposes of this Covenant as deemed necessary by the Department in order to protect the public health or safety, or the environment.

ARTICLE V

ENFORCEMENT

5.01 Enforcement. Failure of the Owner or Occupant to comply with any of the

Restrictions specifically applicable to include grounds for the Department to require that the Owner modify or remove any improvements ("Improvements" herein shall mean all buildings, roads, driveways, and paved parking areas), constructed or placed upon any portion of the Property in violation of the Restrictions. Violation of this Covenant by the Owner or Occupant may result in the imposition of civil and/or criminal remedies including nuisance or abatement against the Owner or Occupant as provided by law. The State of California shall have all remedies as provided at in California Civil Code Section 815.7 as that enactment may be from time to time amended.

ARTICLE VI

VARIANCE AND TERMINATION

6.01 Variance. The Owner, or with the Owner's consent, any Occupant, may apply to the Department for a written variance from the provisions of this Covenant. Such application shall be made in accordance with H&SC section 25233. The Department will grant the variance only after finding that such a variance would be protective of human, health, safety and the environment.

6.02 Termination. The Owner, or with the Owner's consent, any Occupant, may apply to the Department for a termination of the Restrictions or other terms of this Covenant as they apply to all or any portion of the Property. Such application shall be made in accordance with H&SC section 25234. No termination or other terms of this Covenant shall extinguish or modify the retained interest held by the United States.

ARTICLE VII

MISCELLANEOUS

7.01 No Dedication Intended. Nothing set forth in this Covenant shall be

construed to be a gift or dedication, or offer of a gift or dedication, of the Property, or any portion thereof to the general public or anyone else for any purpose whatsoever.

7.02 Recordation. The Covenantor shall record this Covenant, with all referenced Exhibits, in the County of [name of county] within ten (10) days of the Covenantor's receipt of a fully executed original.

7.03 Notices. Whenever any person gives or serves any Notice ("Notice" as used herein includes any demand or other communication with respect to this Covenant), each such Notice shall be in writing and shall be deemed effective: (1) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served, or (2) three (3) business days after deposit in the mail, if mailed by United States mail, postage paid, certified, return receipt requested:

To Owner: *[include name and address of Owner and name of person to receive service]*

To Department: *[title and address of Regional Branch Chief.]*

Any party may change its address or the individual to whose attention a Notice is to be sent by giving written Notice in compliance with this paragraph.

7.04 Partial Invalidity. If any portion of the Restrictions or other term set forth herein is determined by a court of competent jurisdiction to be invalid for any reason, the surviving portions of this Covenant shall remain in full force and effect as if such portion found invalid had not been included herein.

7.05 Statutory References. All statutory references include successor provisions.

IN WITNESS WHEREOF, the Parties execute this Covenant.

Covenantor: **[name of Covenantor]**

By: _____

Title: **[signatory's name and title]**

Date: _____

Department of Toxic Substances Control

By: _____

Title: **[signatory's name and title]**

Date: _____

Approved as to form:

Date: 9 March 00

By: Mary Kay Fanger

Approved as to form:

Date: March 16, 2000

By: Abdul M Thomas

Ratification of Document endorsed 3-2-00



MODEL HAZARDOUS WASTE MANAGEMENT PROGRAM

DEED RESTRICTION

RECORDING REQUESTED BY:

[Covenantor's Name]

[Street Address]

[City], California [Zip Code]

WHEN RECORDED, MAIL TO:

Department of Toxic Substances Control
Region _____

[Street Address]

[City], California [Zip Code]

Attention: [Name of Branch Chief], Chief

[Branch Designation]

SPACE ABOVE THIS LINE RESERVED FOR RECORDER'S USE

COVENANT TO RESTRICT USE OF PROPERTY

ENVIRONMENTAL RESTRICTION

(Re: *[Insert parcel number(s) and name of site property to be restricted.]*)

This Covenant and Agreement ("Covenant") is made by and between the United States of America acting by and through the Department of Navy or "DON" (the "Covenantor"), the current owner of certain property situated in [city], County of _____, State of California, described in Exhibit "A", attached hereto and incorporated herein by this reference (the "Property"), and the State of California acting by and through the Department of Toxic Substances Control (the "Department"). Pursuant to Civil Code section 1471(c), the Department has determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as a

ATTACHMENT B

result of the presence on the land of hazardous materials as defined in Health and Safety Code ("H&SC") section 25260. In addition, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 (42 USC Section 9604), as delegated to the Covenantor by E.O. 12580, ratified by Congress in 10 USC Sec. 2701, et seq., and implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP – 40 CFR Part 300) and implementing guidances and policies, the Covenantor (DON) has also determined that this Covenant is reasonably necessary to protect present or future human health and safety and the environment as the result of the presence on the land of hazardous substances, pollutants and contaminants as defined in CERCLA Section 101 (42 USC Section 9601).

The Covenantor and the Department, collectively referred to as the "Parties", therefore intend that the use of the Property be restricted as set forth in this Covenant, in order to protect human health, safety and the environment.

The Covenantor retains sufficient legal title and interest in the subject property to insure continuing enforcement of the protective covenants and agreements contained within this Covenant to Restrict the Use of Property. Further in any subsequent transfers or conveyance of title to nonfederal entities the DON shall burden the property with additional deed covenants that insure that any subsequent deed or transfer contains the protective covenants and right of access and power to conduct monitoring interest contained herein and of wastes retained on site. Those covenants and agreements shall be enforceable against the servient estate in that those protective covenants shall run with the land to all successors and assigns.

ARTICLE I
STATEMENT OF FACTS

1.01 The Property, totaling approximately [acres] [— square yards] is more particularly described and depicted in Exhibit "A", attached hereto and incorporated herein by this reference. *[Exhibit "A" must include the legal description of the property used by the county recorder. This must include the particular description of the boundaries of the area to be subject to a specific use restriction. A survey may be required].* The Property is located in the area now generally bounded by *[include narrative description of the area; this will typically be street names: e.g. Main Street on the north, Maple Street on the east, etc.]* County of [], State of California.

1.02 *[Use this paragraph if imposing additional restrictions on a portion of the Property, for example on a capped portion, or if for any other reason it is necessary to precisely identify any portion of the property, such as an area with groundwater monitoring wells. The purpose of this paragraph is to give the precise location of such areas where use restrictions will apply. Renumber following paragraphs accordingly]* A limited portion of the Property is more particularly described in Exhibit "B" which is attached and incorporated by this reference ("Capped Property" or "[other identified Property]"). *[Exhibit B must include a legal description of the exact area(s) being restricted and any necessary diagram(s). This will generally require a legal survey and engineering drawing for the Cap or other area to be further restricted.]* The [Capped or {other identified}] Property is located in the area now generally bounded by _____. *[include language that generally describes the Capped or other identified Property]* The

[Capped or {other identified}] Property is also more specifically described as encompassing xxxx County Assessor's Parcel numbers —.

1.03 *[Briefly describe the regulatory oversight of the facility by the Department and the CERCLA decisions including any applicable Federal Facility Agreement (FFA) or Federal Facility site Remediation Agreement (FFSRA) and implementing activities of the Covenantor, the remedial activities that have occurred at the Property, including, if applicable, installation of a cap and construction and ongoing operation and maintenance of a groundwater treatment system. This paragraph should refer to the Closure Report or other decision document such as a ROD which approved the remedial activities at the Property and required this Covenant. The paragraph needs to identify the contaminants and physical remedial measures on the Property which necessitate this deed restriction.]*

Since [date] the Department [or, the Department's predecessor in interest (California Department of Health Services)] authorized this [treatment], [storage], [disposal] facility ("Facility") pursuant to an [interim status document] [permit]. Under this authorization the Site was a hazardous waste facility, regulated by the Department, subject to the requirements of the California Hazardous Waste Control Law ("HWCL"), at Health and Safety Code ("H&S Code") section 25100 et seq., and the federal Resource Conservation and Recovery Act ("RCRA"), at 42 U.S.C. section 6901 et seq. Pursuant to the closure requirements of the HWCL, including H&S Code section 25246 and post-closure notices provisions of Title 22 California Code of Regulations [section 66265.119(b) for interim status hazardous waste facilities] [or 66264.119(b) for permitted hazardous waste facilities]] [or, if restrictions required for permit: corrective

action requirements of the HWCL, including H&S Code Section 25200.10] the Department is requiring this Covenant as part of the [facility closure] [corrective action] [permitting] of the facility. The Department circulated a [Closure Plan] [Remedial Measures Study] [other appropriate document], which contained a Final Health Risk Assessment [and/or Remedial Goals document], together with a draft [Environmental Impact Report] [Negative Declaration] pursuant to the California Environmental Quality Act, Public Resources Code section 21000 et seq for public review and comment from [date] to [date]. Because hazardous wastes, which are also hazardous materials as defined in Health and Safety Code sections 25117 and 25260, including [list hazardous wastes] remain in the [soil] and [groundwater] at the Property, the [Closure Plan] [Remedial Measures Study] provided that a deed restriction would be required as part of the facility remediation. The Department approved the [Closure Plan] [Remedial Measures Study] [other appropriate document] together with the [environmental document] on [date].

Pursuant to these documents, the Property was [describe remedial actions taken which relate to what is left on the property. This description must include installation of any physical remedial measures. The description must identify what contaminants remain on the Property.]

SAMPLE: Hazardous wastes, which are also hazardous materials as defined in H&S Code sections 25117 and 25260, and are CERCLA hazardous substances, pollutants or contaminant, including xxxx and yyyy, remain in the soil and groundwater at the Property. Remediation includes installing and maintaining a synthetic membrane cover ("Cap") over the Capped Property. The Cap consists of a low permeability

synthetic membrane and other associated layers over the hazardous wastes and materials, as more particularly described in the engineering drawing attached as Exhibit "B" hereto. The Remedial Measure also includes the installation and operation of: (1) a passive gas collection system ("GCS") on the Capped Property which removes miscellaneous gas/vapors migrating upward from under the Cap, (2) a vapor extraction system ("VES"), which remediates certain volatile organic compound-impacted soils, and (3) groundwater monitoring wells ("Monitoring Wells"). The location of the GCS, VES and Monitoring Wells are shown on the map attached as exhibit "—". The operation and maintenance ("O&M") of the Cap, GCS, VES, and Monitoring Wells is pursuant to an O&M Manual incorporated into the O&M Agreement between [Covenantor] [or name of other entity] and the Department dated September 20, 1995. [If an O&M Agreement has not been signed, the approval date for the O&M Manual or Plan should be referenced]

1.04 *[This paragraph should set out specific information about the risk assessment findings relevant to the contaminants of concern remaining at the property, essentially the basis for the restrictions imposed by this covenant. The Restrictions in Paragraphs 4.01, and any requirement for Soil Management Activity and any Prohibited Activity must be linked to the contaminants and risk assessment as discussed in this paragraph. The following paragraph is given for purposes of illustration. Each site will have different facts; those should be developed in a manner similar to the sample paragraph given here. You must consult with the assigned toxicologist about what are the appropriate land uses.]*

SAMPLE: As detailed in the Final Health Risk Assessment [or other appropriate

document] as proposed by the Covenantor and approved by the Department on *[date]*, all or a portion of the surface and subsurface soils within 10 feet of the surface of the Property contain hazardous wastes and hazardous materials, as defined in H&S Code section 25117 and 25260, which include one or more of the following metal contaminants of concern in the ranges set forth below: arsenic (0.3 to 38.1 parts per million ("ppm")), beryllium (2.6 ppm), copper (4.6 to 756 ppm, and nickel (7.3-105 ppm). In addition, there are low pH soils. Based on the Final Risk Assessment the Department and the Covenantor have concluded that use of the Property as a residence, hospital, school for persons under the age of 21 or day care center would entail an unacceptable cancer risk to the users or occupants of such property. The Department and the Covenantor have further concluded that the Property, as remediated, and operated or occupied subject to the restrictions of this Covenant, does not present an unacceptable threat to human safety or the environment, if limited to *[as applicable: commercial and industrial use, parks, open space, [or other appropriate] use]*.

SAMPLE [Note: Groundwater restrictions in Paragraph 3.04 must be based on a discussion of what contaminants are found in groundwater at the site, and what drinking water standards are.]: Groundwater at the Property is first found at 15 to 20 feet below ground surface. Contaminants in the groundwater include benzene (50- 123 ppm), chromium (75- 213 ppm) and TCE (350-780 ppm). California drinking water standards are benzene at .08 ppm, chromium at 30 ppm and TCE at 5 ppm. The Department and the Covenantor concludes that the groundwater presents an unacceptable threat to human health and safety absent an environmental restriction to eliminate exposure to such levels of groundwater.

ARTICLE II

DEFINITIONS

2.01 Department. "Department" shall mean the State of California by and through the California Department of Toxic Substances Control and shall include its successor agencies, if any.

2.02 Owner. "Owner" shall include the Covenantor's successor's in interest, and their successors in interest, including heirs and assigns, during his or her ownership of all of any portion of the Property.

2.03 Occupant. "Occupant" shall mean Owners and any person or entity entitled by ownership, leasehold, or other legal relationship to the right to occupy any portion of the Property.

2.04 Covenantor. "Covenantor" shall mean the United States acting through the Department of the Navy (DON).

ARTICLE III

GENERAL PROVISIONS

3.01 Restrictions to Run With the Land. This Covenant sets forth protective provisions, covenants, restrictions, and conditions (collectively referred to as "Restrictions"), upon and subject to which the [Property] [Capped Property] [Restricted Property] and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are consistent with the separate restrictions placed in the deed by and in favor of the Covenantor, conveying the Property from the Covenantor to its successor in interest described above. Each and every one of the Restrictions: (a) shall run with the land in perpetuity pursuant to H&SC sections 25202.5, and 25202.6, and Civil Code section 1471; (b) shall inure to the benefit of and pass with each and every portion of the Property; (c) shall apply to and bind all subsequent Occupants of the Property; (d) are for the benefit of, and shall be enforceable by the State of California; and (e) are imposed upon the entire Property unless expressly stated as applicable only to a specific portion thereof.

3.02 Binding Upon Owners/Occupants. Pursuant to Health and Safety Code section 25202.5(b), this Covenant shall be binding upon all of owners of the land, their heirs, successors, and assignees, and the agents, employees, and lessees of the owners, heirs, successors, and assignees. Pursuant to Civil Code section 1471(b), all successive owners of the Property are expressly bound hereby for the benefit of the covenantee(s) herein.

3.03 Written Notice of Hazardous Substance Release. The Owner shall, prior to the sale, lease, or rental of the Property, give written notice to the subsequent

transferee that a release of hazardous substances has come to be located on or beneath the Property, pursuant to Health and Safety Code section 25359.7. Such written notice shall include a copy of this Covenant. *[This last sentence is optional, to be used at sites where it is important that buyers and tenants be specifically aware of the ongoing remediation and their obligations]*

3.04 Incorporation into Deeds and Leases. The Restrictions set forth herein shall be incorporated by reference in each and all deeds and leases for any portion of the Property.

3.05 Conveyance of Property Covenantor agrees that the Owner shall provide notice to the Department not later than thirty (30) days after any conveyance of any ownership interest in the Property (excluding mortgages, liens, and other non-possessory encumbrances). The Department shall not, by reason of this Covenant alone, have authority to approve, disapprove, or otherwise affect such conveyance. *[This paragraph is optional, to be used, for example, at sites with groundwater treatment systems that will require access by the Department and by the entity responsible for O&M.]*

ARTICLE IV

RESTRICTIONS

[The following examples are intended to be illustrative. Not all of them will be applicable. The restrictions for a particular property should have a direct relationship to what the Health Risk Assessment said was ok/appropriate for use at the site. The toxicologist must be involved with drafting the Restrictions. The restrictions must also protect the integrity of, and access to, any ongoing remediation facilities at the site.]

4.01 Prohibited Uses. The Property shall not be used for any of the following purposes: *[Note: These prohibitions must be based on the facts and Health Risk Assessment as set forth in Paragraph 1.04]*

[sample provisions]

(a) A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation.

(b) A hospital for humans.

(c) A public or private school for persons under 21 years of age.

(d) A day care center for children.

4.02 Soil Management *[Note: The basis for the soil restrictions must be in Paragraph 1.04]*

[sample provisions]

(a) No activities which will disturb the soil *[at or below xxx feet below grade]* (e.g., excavation, grading, removal, trenching, filling, earth movement or mining) shall be permitted on the Property without a Soil Management Plan and a Health and Safety Plan submitted to the Department for review and approval.

(b) Any contaminated soils brought to the surface by grading, excavation, trenching or backfilling shall be managed in accordance with all applicable provisions of state and federal law.

(c) The Owner will provide the Department written notice at least fourteen (14) days prior to any building, filling, grading, mining or excavating in the Property *[more than feet below the soil surface]* *[which will remove more than cubic yards of soil]*.

4.03 Prohibited Activities. *[This paragraph will not be applicable to all sites. If*

not used, renumber accordingly. If there are groundwater restrictions, the basis must be in Paragraph 1.04] The following activities shall not be conducted at the Property:

[sample provisions]

(a) No raising of agricultural products intended for human consumption or use, including but not limited to food, cattle, fibers including, cotton) shall be permitted on the property.

(b) No drilling for [drinking/IRRIGATION] water, oil, or gas shall be permitted on the Property [without prior written approval by the Department]. *[or]* (b) No groundwater shall be extracted on the Property for purposes other than site remediation or construction dewatering. *[The following paragraphs are samples of restrictions that may be applicable when there is a cap, vapor and/ or gas collection system, and/or groundwater monitoring system.]*

4.04 Non-Interference with Cap [and VES] and [GCS].

[sample provisions]

(a) No activities which will disturb the Cap (e.g. excavation, grading, removal, trenching, filling, earth movement, or mining) shall be permitted on or within _____ feet of the Capped Property without prior review and approval by the Department. *[Similar restrictions may be appropriate for other ongoing remediation systems.]*

(b) All uses and development of the Capped Property shall preserve the integrity of the Cap. *[Extend to other systems as appropriate.]*

(c) Any proposed alteration of the Cap shall require written approval by the Department.

(d) The Owner shall notify the Department of each of the following: (i) The

type, cause, location and date of any disturbance to the Cap which could affect the ability of the Cap to contain subsurface hazardous wastes or hazardous materials in the Capped Property, and (ii) the type and date of repair of such disturbance. Notification to the Department shall be made as provided below within ten (10) working days of both the discovery of any such disturbance(s) and the completion of any repairs. Timely and accurate notification by any Owner or Occupant shall satisfy this requirement on behalf of all other Owners. *[Extend to other systems as appropriate.]*

4.05 Access for Department. The Department shall have reasonable right of entry and access to the Property for inspection, monitoring, and other activities consistent with the purposes of this Covenant as deemed necessary by the Department in order to protect the public health and safety and the environment.

ARTICLE V

ENFORCEMENT

5.01 Enforcement. Failure of the Owner or Occupant to comply with any of the Restrictions specifically applicable to it shall be grounds for the Department, by reason of this Covenant, to require that the Owner modify or remove any improvements ("Improvements" herein shall include all buildings, roads, driveways, and paved parking areas, constructed or placed upon any portion of the Property constructed in violation of the Restrictions). Violation of this Covenant by the Owner or Occupant may result in the imposition of civil and/or criminal remedies including nuisance or abatement against the Owner or Occupant as provided by law. The State of California shall have all remedies as provided in California Civil Code, Section 815.7, as that enactment may

be from time to time amended.

ARTICLE VI

MODIFICATION AND TERMINATION

6.01 Modification. Any Owner or, with the Owner's written consent, any Occupant of the Property or any portion thereof may apply to the Department for a written modification from the provisions of this Covenant. Such application shall be made in accordance with H&S Code section 25202.6. The Department will grant the modification only after finding that such a modification would be protective of human health, safety and the environment.

6.02 Termination. Any Owner, and/or, with the Owner's written consent, any Occupant of the Property, or any portion thereof, may apply to the Department for a termination of the Restrictions or other terms of this Covenant as they apply to all or any portion of the Property. Such application shall be made in accordance with H&S Code section 25202.6. The Department will grant the termination only after finding that such a termination would be protective of human health, safety and the environment. No termination of the Restrictions or other terms of this Covenant shall extinguish or modify the retained interest held by the United States.

ARTICLE VII

MISCELLANEOUS

7.01 No Dedication Intended. Nothing set forth in this Covenant shall be construed to be a gift or dedication, or offer of a gift or dedication, of the Property, or any portion thereof to the general public or anyone else for any purpose whatsoever.

7.02 Recordation In accordance with HSC Section 25235, the Department will record this Covenant, with all referenced Exhibits, in the County of [name of county] within ten (10) days of the Department's receipt of a fully executed original.

7.03 Notices. Whenever any person gives or serves any notice ("Notice" as used herein includes any demand or other communication with respect to this Covenant), each such Notice shall be in writing and shall be deemed effective: (1) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served, or (2) three (3) business days after deposit in the mail, if mailed by United States mail, postage paid, certified, return receipt requested:

To Owner: *[include name and address of Owner and name of person to receive service]*

To Department: *[include name, address, and appropriate name of Department person to be served]*

Any party may change its address or the individual to whose attention a notice is to be sent by giving written notice in compliance with this paragraph.

7.04 Partial Invalidity. If any portion of the Restrictions or other term set forth herein is determined by a court of competent jurisdiction to be invalid for any reason, the surviving portions of this Covenant shall remain in full force and effect as if such portion found invalid had not been included herein.

7.05 Statutory References. All statutory references include successor provisions.

IN WITNESS WHEREOF, the Parties execute this Covenant.

"Covenantor"

Date: _____

By: _____

"Department"

Date: _____

By: _____

Approved as to form:

Date: 9 March 00

By: MX Fayer

Approved as to form:

Date: March 16, 2000

By: Donald M. Thomas

Reaffirmation of Document endorsed 3-2-00

COUNTY OF

personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is /are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

Signature _____



California Regional Water Quality Control Board

San Francisco Bay Region



Winston H. Hickox
Secretary for
Environmental
Protection

Internet Address: <http://www.swrcb.ca.gov>
1515 Clay Street, Suite 1400, Oakland, California 94612
Phone (510) 622-2300 • FAX (510) 622-2460

Gray Davis
Governor

Date: **SEP 25 2003**
File No. 2169.6032 (JSM)
PCA No.: 16525

Mr. Keith Forman
BRAC Environmental Coordinator
Naval Facilities Engineering Command
Southwest Division
1230 Columbia Street, Suite 1100
San Diego, CA 92101-8517

Subject: Concurrence that A-Aquifer Groundwater at the Hunters Point Naval Shipyard, San Francisco, Meet the Exemption Criteria in the SWRCB Sources of Drinking Water Resolution 88-63

Dear Mr. Forman:

Regional Water Quality Control Board (RWQCB) staff have reviewed your letter to Ms. Julie Menack dated August 11, 2003 regarding the Navy's request for written concurrence that groundwater in the A-aquifer at Hunters Point Naval Shipyard meets the exemption criteria for State Water Resources Control Board (SWRCB) Resolution No. 88-63. In your letter, the Navy evaluated existing and potential beneficial uses of groundwater at Hunters Point (see letter attached). Based on RWQCB staff review of the data provided, RWQCB staff find that the quality and the hydrogeologic conditions of A-aquifer groundwater beneath Hunters Point is such that this water is not a potential source of drinking water pursuant to SWRCB Resolution 88-63 and RWQCB Resolution No. 89-39.

If you have questions, please feel free to contact Julie Menack at (510) 622-2401 or by electronic mail at jsm@rb2.swrcb.ca.gov.

Sincerely,

Curtis T. Scott, Division Chief
Groundwater Protection and
Waste Containment Division

Attachment: Letter from Keith Forman (minus attachments)

Cc: Mailing list attached

**Hunters Point Naval Shipyard
Mailing List**

Marie Avery
Department of the Navy
Southwest Division/Naval Facilities Engineering Command
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San Diego, CA 92131-5190

G. Patrick Brooks, Lead RPM
Naval Facilities Engineering Command
Southwest Division
1230 Columbia Street, Suite 1100
San Diego, CA 92101-8517

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U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
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California Department of Toxic Substances Control
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Department of Public Health
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San Francisco, CA 94105

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Tetra Tech EMI
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San Francisco, CA 94105

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5075 Third Street
San Francisco, CA 94124

Mr. Patrick Shea
Government Information Center, 5th Floor
100 Larkin Street
San Francisco, CA 94102

Mr. Gregg Olson
San Francisco Public Utilities Commission (PUC)
1155 Market Street, 4th Floor
San Francisco, CA 94103

Mr. Lynne Brown
HPSY RAB Co-Chair
24 Harbor Road
San Francisco, CA 94124

Ms. Lea Loizos
HPSY RAB Technical Review Subcommittee
833 Market Street, Suite 1107
San Francisco, CA 94103

Groundwater Exemption Criteria.doc



DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132 - 5100

5090
Ser 06CH.KF\1137
August 11, 2003

Ms. Julie Menack
California Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Dear Ms. Menack:

Subj: REQUEST FOR DRINKING WATER DETERMINATION A-AQUIFER EXEMPTION
FROM CONSIDERATION AS A MUNICIPAL OR DOMESTIC WATER SUPPLY,
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The A-aquifer groundwater beneath Hunters Point Shipyard (HPS) in San Francisco, California, is not of sufficient quality to be used as a potential drinking water source pursuant to State Water Resources Control Board (SWRCB) Sources of Drinking Water Policy Resolution 88-63 (SWRCB Resolution 88-63) and California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region, Resolution 89-39. The Navy respectfully requests that RWQCB grant an exemption for the A-aquifer at HPS from consideration as a suitable or potentially suitable municipal or domestic water supply on the basis of criteria contained in SWRCB Resolution 88-63 and RWQCB Resolution 89-39.

The exemption being requested is for drinking water only; the Navy acknowledges that the A-aquifer recharges San Francisco Bay (the Bay), and we are committed to its protection. Groundwater discharge to San Francisco Bay will be evaluated to ensure protectiveness of potential ecological receptors. Additionally, volatile organic compounds in the A-aquifer will be evaluated as a potential human health risk because of their volatility and the potential for human exposure via indoor air. The requested exemption would help the Navy focus on evaluating groundwater remedial alternatives that are protective of the Bay and deeper groundwater found in the B-aquifer and bedrock water-bearing zone, and would help the Navy streamline the feasibility studies for Parcels C, D, and E, and the risk management review summary report for Parcel B. Resolution 88-63 states that "All surface and ground waters of the State are considered to be suitable, or potentially suitable for municipal or domestic water supply and should be so designated by the Regional Boards with the exception of surface and ground waters where:

5090
Ser 06CH.KF\1137
August 11, 2003

- The total dissolved solids (TDS) exceed 3,000 mg/L (5,000 μ S/cm, electrical conductivity) and it is not reasonably expected by Regional Boards to supply a public water system, or
- There is contamination, either by natural processes or by human activity (unrelated to the specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or
- The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day."

The Navy finds that A-aquifer groundwater beneath HPS is not suitable as a drinking water source and meets the exemption criteria in SWRCB Resolution 88-63 and RWQCB Resolution 89-39 because:

- Total dissolved solids (TDS) concentrations in A-aquifer groundwater exceed 3,000 milligrams per liter (mg/L)
- Artificial fill comprises most of the A-aquifer
- Naturally occurring dissolved metals concentrations have been estimated (Hunters Point groundwater ambient levels [HGAL]), and some of these metals concentrations exceed drinking water maximum contaminant level (MCL) when the metal is at or below its HGAL
- There is no historical, present, or planned future use of groundwater at HPS
- Well construction requirements prohibit water supply wells in most parts of HPS
- Pumping would cause saltwater intrusion in areas where potable wells could conceivably be installed

The Navy has found that groundwater does not meet criteria for municipal and domestic water supply based on the hydrogeologic conditions and other limiting factors at the Navy Fleet and Industrial Supply Center Oakland (FISCO); the Alameda Annex in Oakland, California; and Naval Station Treasure Island, San Francisco, California. HPS and the sites listed above are Bay margin sites that should be evaluated similarly. RWQCB has written letters of concurrence that groundwater meets the exemption criteria in the SWRCB Resolution 88-63 for FISCO, the Alameda Annex, and Naval Station Treasure Island.

The following discussion describes the groundwater conditions at HPS and the factors that the Navy believes preclude the use of the A-aquifer as a suitable or potentially suitable municipal or domestic water supply.

GEOLOGY AND HYDROGEOLOGY

The peninsula forming HPS is within a northwest-trending belt of the Franciscan Complex bedrock known as the Hunters Point Shear zone. Six geologic units underlie HPS: five unconsolidated sedimentary deposits of Quaternary age and the Jurassic-Cretaceous-age Franciscan Complex bedrock. In general, the stratigraphic sequence of these geologic units, from youngest (shallowest) to oldest (deepest), is as follows: Artificial Fill, Slope Debris and Ravine Fill, Undifferentiated Upper Sand Deposits, Bay Mud Deposits, Undifferentiated Sedimentary Deposits, and the Franciscan Complex.

Three water-bearing units underlie the site. The shallowest water-bearing zone is referred to as the A-aquifer. The A-aquifer is essentially manmade and consists primarily of Artificial Fill material, but also includes Slope Debris and Undifferentiated Upper Sand Deposits. Of the 493 acres of land surface at HPS, about 400 acres were created by infilling the Bay with upland sediments. The A-aquifer was primarily created by removing soil from upland areas at HPS and depositing the soil in the Bay. Residuum of the Franciscan Formation is included in the fill. Depth to groundwater in the A-aquifer ranges from 2 to 17 feet below ground surface (bgs), and the thickness of the A-aquifer ranges from about 10 to 70 feet, but is most commonly 20 to 40 feet thick. Although groundwater flow is locally complex, groundwater in the A-aquifer generally flows toward the Bay, except where reversed due to the influence of leaking storm drains, sewer/ water supply lines.

The A-aquifer is separated from the deeper water-bearing zone, referred to as the B-aquifer, by the Bay Mud in most locations across the site. The B-aquifer consists of Undifferentiated Sedimentary Deposits underlying the Bay Mud. The bedrock water-bearing zone is present in the upper weathered portions of the Franciscan Complex Bedrock. In some areas, the A-aquifer directly overlies the bedrock water-bearing zone. Groundwater in the bedrock occurs in localized discrete fractures. Groundwater recharge at HPS occurs through infiltration of precipitation in the unpaved areas, lateral flow from topographically high areas (Parcel A), and piping system leakage from storm drains, potable water lines, and sanitary sewer lines.

GROUNDWATER QUALITY: TDS DISTRIBUTION

The average TDS concentration in the A-aquifer at HPS is greater than the 3,000-mg/L standard cited in SWRCB Resolution 88-63. The average TDS concentration was determined from analytical results of groundwater wells sampled as part of the groundwater data gaps investigation and other Comprehensive Environmental Response, Compensation, and Liability Act sampling events from 1990 through 2002. Figure 1 shows the average TDS concentrations at individual wells.

Table 1 presents TDS concentrations in groundwater samples from A-aquifer wells. Based on the average TDS concentration in A-aquifer wells shown on Figure 1, the average TDS concentration in the A-aquifer in Parcels B, C, D, and E is 7,219 mg/L.

Although the average TDS concentrations presented on Figure 1 used data collected from 1990 to 2002 without regard to season, a significant amount of time-discrete TDS data was collected during the groundwater data gaps investigation at Parcels C, D, and E, which allows evaluation of seasonal effects. Average TDS concentrations from Winter 2001 and Summer 2002 are presented in the table below:

Average TDS Concentrations in the A-Aquifer (2001-2002) at Parcels C, D, and E

February to March 2001 Average TDS Concentration (mg/L) [Number of Wells Used to Calculate Average]	July to August 2002 Average TDS Concentration (mg/L) [Number of Wells Used to Calculate Average]
6,243 [218]	6,818 [168]

Based on these average TDS values, it is clear that the average A-aquifer TDS concentration at HPS is well above the RWQCB standard of 3,000 mg/L. Much of HPS is reclaimed tideland, and the high TDS values are consistent with historical infilling of the Bay.

GROUNDWATER QUALITY: CONDUITS AND THEIR EFFECT ON TDS DISTRIBUTION

Underground utilities have the potential to affect TDS concentrations and water quality in the A-aquifer. Leaking potable water supply lines may reduce the TDS concentration by adding potable water to the A-aquifer. Leaking water supply lines may be the source of many of the isolated low TDS anomalies shown on Figure 1. For example, potable water lines are near the anomalies centered on wells IR36MW125A, IR34MW36A, IR39MW21A, IR17MW12A, and others. Leaking storm drain lines that are tidally influenced may add seawater to the A-aquifer, thereby increasing TDS.

Some groundwater leaks into sanitary sewer lines and is eventually pumped off the base as part of the sanitary sewer effluent. Removal of groundwater via the sanitary sewer causes the water table to be lowered in the area around the leaking lines. In some cases the water table elevation is below sea level. This allows seawater to intrude into the A-aquifer. Figure 2 shows the presence of sanitary sewer lines, and the yellow-shaded area along the border between Parcels D and E shows locations where the A-aquifer surface is below sea level.

GROUNDWATER QUALITY: NATURALLY OCCURRING DISSOLVED METALS

Antimony, arsenic, chromium, magnesium, nickel, thallium, zinc, and other metals are components of the Franciscan Formation bedrock and bedrock-derived fill that underlies HPS. The A-aquifer contains fill material and residuum derived from the Franciscan Formation. HGALs were estimated for naturally occurring metals concentrations during the remedial investigation (RI). Antimony, arsenic, and thallium concentrations exceed their primary MCLs, even when concentrations of these metals were at or below

their HGALs, as shown on Figure 3 and in Table 2. The presence of naturally occurring dissolved metals coupled with high TDS concentrations in the A-aquifer suggests that the A-aquifer is nonpotable.

GROUNDWATER AND WELL YIELDS

Hydraulic characteristics of the A-aquifer have been determined across HPS during the RI activities through constant rate aquifer tests and slug testing. Aquifer properties derived from aquifer tests and slug tests at Parcels C and E presented in Table 3 reveal low yield conditions and poor storage capacities. In general, monitoring wells installed in the A-aquifer are low yielding, but are capable of producing at least 200 gallons per day. The Navy is not requesting an exemption based on well yield; however, if the A-aquifer were used as a municipal or domestic water supply, it can be reasonably expected that saltwater intrusion would increase TDS concentrations in A-aquifer groundwater.

HISTORICAL, CURRENT, AND POTENTIAL FUTURE GROUNDWATER USE

San Francisco and HPS's potable or drinking water supply is obtained from the Hetch Hetchy system operated by the San Francisco Water Department. There are no groundwater supply wells and there is no record of historical groundwater use at HPS. The only groundwater wells at HPS are monitoring wells related to environmental investigations of HPS. These monitoring wells cannot be used for water supply because the wells do not meet state well construction standards for water supply wells. Currently, the city prohibits the installation of domestic water supply wells. This City prohibition indicates a low potential for groundwater at HPS to be used as a drinking water source.

WELL CONSTRUCTION REQUIREMENTS

The California Department of Water Resources (DWR) has developed standard well construction requirements to prevent contamination of water supply wells by chemicals and biologic hazards related to point and nonpoint sources (DWR, "California Well Standards, 1991" Bulletin 74-90). The California Well Standards require that annular seals must extend at least 50 feet bgs for community and industrial water supply wells and at least 20 feet bgs for domestic, agricultural, and other types of water supply wells.

Assuming a minimum 10-foot-long well screen, an individual domestic well would extend to a minimum depth of 30 feet bgs, and domestic wells could be installed only where the A-aquifer is at least 30 feet thick. Assuming a minimum depth of 60 feet bgs for community and industrial supply wells, these wells could be installed in the A-aquifer only in areas where the A-aquifer is more than 60 feet thick. As noted above in the discussion of hydrogeology of HPS, the A-aquifer thickness ranges from about 10 to 70 feet, but is most commonly 20 to 40 feet.

The California Well Standards also require a minimum horizontal separation distance of 50 feet from sanitary, industrial, and storm sewer lines. HPS has an extensive network of sewer lines that further restrict the areas at HPS where domestic or municipal water supply wells could be installed. Given the thickness of the A-aquifer and the extensive utility line network at HPS, there are very few areas at HPS where wells could be installed meeting this criterion.

SALTWATER INTRUSION AND LAND SUBSIDENCE

HPS is adjacent to and juts into the San Francisco Bay. Before the creation of land at HPS, most of the current HPS land area was beneath the surface of the Bay. HPS is adjacent to and is underlain by saltwater. Long-term pumping of shallow groundwater from the Artificial Fill would induce further saltwater intrusion and would cause TDS concentrations to increase in the pumping well. Prolonged pumping of shallow groundwater at HPS would result in dewatering and compaction of the shallow sediments, which would result in land subsidence. Compaction would increase the potential for differential settlement of the soils and could lead to possible damage to overlying structures.

CONCLUSION AND RECOMMENDATIONS

The A-aquifer groundwater beneath HPS in San Francisco, California, is not of sufficient quality to be used as a potential drinking water source pursuant to SWRCB Resolution 88-63 and RWQCB Resolution 89-39.

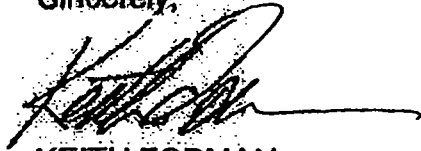
The basis for this exemption request is summarized as follows. High TDS precludes the use of the A-aquifer for drinking water. The average TDS concentration in the A-aquifer is about 7,400 mg/L, and very few areas have A-aquifer TDS concentrations less than 3,000 mg/L, which makes the A-aquifer unsuitable for use as a municipal or domestic water supply. Furthermore, pumping would induce saltwater intrusion, which would increase TDS concentrations in pumping wells. Additionally the A-aquifer contains Franciscan Formation deposits with naturally occurring metals that are also found dissolved in A-aquifer groundwater at HPS at concentrations exceeding drinking water criteria. There is no historic or current use of groundwater at HPS, and potential future use of groundwater at HPS for a drinking water supply is limited by California well construction standards.

Finally, San Francisco HPS's potable drinking water supply is obtained from the Hetch Hetchy system operated by the San Francisco Water Department. The City of San Francisco prohibits the installation of domestic water supply wells at HPS.

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The Navy requests that the RWQCB provide written concurrence that A-aquifer groundwater at HPS meets the criteria for exemption from consideration as a suitable or potentially suitable municipal or domestic water supply in SWRCB Resolution 88-63 and RWQCB Resolution 89-39. Should you have any questions about this matter, please contact me at (619) 532-0913.

Sincerely,



KEITH FORMAN
BRAC Environmental Coordinator
By direction of the Commander

- Enclosures:
1. Figure 1, Mean Total Dissolved Solids Concentrations in the A-Aquifer with Unsmoothed Interpretation of Salinity Zones
 2. Figure 2, A-Aquifer Groundwater Elevations, February 20, 2002
 3. Figure 3, Ambient Metals Concentrations in the A-Aquifer Exceeding Maximum Contaminant Levels
 4. Table 1, Total Dissolved Solids: Analytical Results for Groundwater in the A-Aquifer
 5. Table 2, Summary of Ambient Metals Analytical Results Exceeding Maximum Contaminant Levels in the A-Aquifer
 6. Table 3, Hydraulic Conductivity Values for Parcels C and E

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SUBJECT: Water Board Position on Groundwater Evaluation Criteria, Points of Compliance, and Next Steps, Hunters Point Shipyard, San Francisco

Dear Mr. Forman:

This letter responds to the groundwater/surface water interaction meeting topics that were presented at the December 2005 and January 2006 Hunters Point Shipyard (HPS) BRAC Cleanup Team (BCT) meetings. We want to reiterate our position on the use of numerical water quality criteria for priority pollutants promulgated in the California Toxics Rule¹ in evaluating groundwater that discharges to the Bay from HPS. In the past the Navy, at our request, used these criteria to screen groundwater contaminant plumes in Parcels B, C and D and E.

We want to:

- Clarify our position on the locations of the points of compliance (POC) for measuring (pollutants in) groundwater prior to its discharge to the Bay;
- Encourage incorporating both fate and transport modeling and sampling as a means of evaluating the attenuation of contaminant groundwater plumes;
- Provide case examples where the groundwater/surface water interface was successfully² addressed; and
- Present recommend next-steps aimed at resolving this issue while avoiding project schedule delays.

BACKGROUND

In the past, the Navy BCT expressed concerns over:

¹ 40 CFR Part 131, Volume 65, Number 97 (Rules and Regulations), May 18, 2000.

² Successfully is defined as all parties, including the responsible party, concurring with the approach of utilizing numerical water quality criteria, evaluating contaminant attenuation, and establishing onshore points of compliance in evaluating impacts of contaminated groundwater to the Bay.

- The appropriateness (i.e., legal precedence, over protection and over conservatism) of applying surface water screening criteria to monitoring wells to trigger further groundwater investigation and/or remediation;
- Where the point of compliance for surface water criteria (i.e. distance from shoreline) would be located for groundwater plumes relative to the shoreline; and,
- The availability of methods (i.e., special field mobilizations each time) and anticipated higher costs associated with accurately measuring groundwater discharge to the Bay.

In response to the above concerns, we provided the Navy BCT with:

- The applicable water quality criteria for screening HPS groundwater plumes;
- Recommended changes to the locations of the points of compliance for groundwater relative to Bay, and,
- Recommended sampling strategies for assessing the zone of interaction between groundwater and surface water.

We have also stated that isolated groundwater contaminant hits, as determined by the BCT, should be monitored for a period to determine contaminant trends but not trigger active remedial action.

GROUNDWATER SCREENING/EVALUATION CRITERIA

Attachment 1 presents our recommended prioritization of groundwater screening/evaluation criteria. In August 2003 these criteria were provided to the BCT and remain unchanged. We advocate the use of these criteria because we need to ensure that applicable water quality criteria for the protection of aquatic saltwater life and humans that consume fish are considered at sites where contaminated groundwater plumes discharge to surface water. Because groundwater at HPS has been identified as unsuitable for municipal or domestic water supply, human ingestion of shallow groundwater is not being evaluated; therefore drinking water maximum contaminant levels (MCLs) are not considered appropriate screening tools.

In the past, the Navy has applied the attached screening criteria to groundwater data collected from wells located within 250-feet of the Bay. The 250-foot boundary is consistent with boundary that was established in the petroleum program. We support with the use of the 250-foot assessment boundary.

POINT OF COMPLIANCE (POC)

POC locations for groundwater plumes relative to the Bay have been the subject of much discussion. We agree that in the absence of preferential pathways and conduits which tend to act as "short-circuits" for groundwater discharge to the Bay, that the application of surface water criteria as a means of triggering remedial action in groundwater located a significant distance from shore is probably not appropriate.

Since about 2001, we have consistently encouraged selecting POC locations that maximize natural attenuation mechanisms while minimizing the false positive indications of groundwater impacts.³

With respect to the use of fate and transport modeling, as we reported in the December 2005 BCT, we support using fate and transport modeling as a means of predicting plume attenuation with distance from source. Groundwater fate and transport factors such as adsorption, dispersion, degradation, physical mixing of groundwater, and other factors, should be considered before triggering remedial activities within the 250-foot assessment boundary.

Our recommended POC locations for the groundwater program would specify shoreline monitoring locations just inland of the point where tidal mixing occurs (i.e., within the receiving water). Monitoring strategies that should demonstrate plume attenuation and stability include a time-integrated measuring apparatus such as diffusion samplers, push pore water samplers, temporary multi-level monitoring points, and/or seepage drums.

CASE EXAMPLES

The following provides three case examples (two Navy and one private site) where:

- Remediation goals for shoreline groundwater were derived from surface water quality criteria,
- Fate and transport modeling was used in calculating site-specific attenuation factors; and,
- Multi-depth monitoring wells are proposed to evaluate the groundwater migration pathway and magnitude of groundwater discharge (i.e., flux) from an upland area through the tidal influence zone and then onto the Bay.

These case examples demonstrate our consistent approach relative to the evaluation of groundwater/surface water pathway and also demonstrate that currently available technology, such as multi-depth monitoring wells, can be employed in assessing groundwater flux in a shoreline setting.

- Naval Station Treasure Island (TI) – Groundwater quality in the proximity of the TI shoreline was screened against CTR, National Ambient Water Quality and Basin Plan criteria similar to tiered approach provided in Attachment 1. These screening criteria can be found in the 2003 Groundwater Status Report, for Naval Station Treasure Island. A tidal mixing study was also performed at TI in an effort to estimate the distance inland from the shoreline over which tidal mixing of surface water and groundwater occurs and the percent mixing of surface water and groundwater for each shoreline area of TI. The derived tidal mixing factors were then applied to toxicity screening criteria to estimate an allowable concentration of a pollutant that can enter the tidal mixing zone and whose concentrations would not exceed toxicity screening criteria at the shoreline.

³ May 9, 2001, Letter from Water Board Division Chief Mr. Curtis Scott to Navy Base Environmental Coordinator Mr. Richard Mach; Groundwater Monitoring Strategy, Hunters Point Shipyard, San Francisco, CA.

- IR Site 28, Todd Shipyards, Alameda Point (Site 28) – Similar to HPS and TI, shallow groundwater beneath Site 28 is not used for consumptive purposes. Potential discharge of shallow contaminated groundwater to the surface water is the primary pathway for risk to the environment for groundwater near the shoreline. Therefore, the remediation goals for shoreline groundwater are based on reducing the potential risk to offshore receptors from site-related contaminants. Remediation goals for the shoreline groundwater were derived from numerical water quality criteria for priority pollutants promulgated in the CTR and Enclosed Bays and Estuaries Plan.
- Potrero Power Plant Site, 1201 Illinois Street, San Francisco: Pacific Gas & Electric has proposed an investigation to better understand and quantify the concentrations of chemicals of potential environmental concern (COPEC) in groundwater discharging to the shoreline sediments and to the Bay from the upland area of the Potrero Power Plant site. The study will assess the hydrologic characteristics of the tidal influence zone (i.e., the area along the shoreline where fresh groundwater and brackish Bay water interact) and the magnitude of groundwater flux from upland areas of the site through the tidal influence zone sediments and into the Bay. Investigation activities proposed to address these data needs include the installation of several multi-level monitoring points along two transects, parallel to groundwater flow, and which run from the upland portion of the site to the shoreline area (between high and low tides). These data will be used to evaluate attenuation of dissolved COPEC concentrations from upland portions of the site through the tidal influence zone and assess the need for management of COPECs in groundwater discharging from the site to shoreline sediments and to the Bay.

NEXT STEPS

For the last several years we have relayed a consistent message with respect to the application of water quality (i.e., CTR) screening criteria to near shore groundwater contaminant plumes⁴. We have demonstrated a willingness to work with the BCT to resolve these issues and have provided the BCT with suggestions on ways to monitor the groundwater/surface water transition zone. It appears that in spite of these efforts, the Parcel B TMSRA and Parcel D feasibility studies are nearing completion and that issues surrounding the evaluation of the groundwater/surface water pathway are still unresolved.

In an effort to avoid project delays and resolve our issues and concerns, I propose that we have a meeting and elevate this issue to a higher management level within our respective organizations.

I ask that in preparation for this meeting, that the Navy provide us with:

- Appropriately scaled maps and tables that clearly show the areas of groundwater concern for Parcels B and D; and,

⁴ Groundwater Screening levels to Protect Aquatic Habitats at Hunters Point Shipyard were provided in the following letters:

- 1) July 3, 2003, Water Board Comment letter on the Parcel D Information Package for IR Site 22, from Water Board Project Manager Julie Menack to Navy BEC Keith Forman.
- 2) July 3, 2003, Comment letter from on the March 19, 2003 Parcel C Groundwater Summary Report, Phase III Data Gaps Investigation, from Water Board Project Manager Julie Menack to Navy BEC Keith Forman.
- 3) August 8, 2003, Comment letter on the May 21, 2003 Parcel E Groundwater Summary Report, Phase III Groundwater Data Gaps Investigation, from Water Board Project Manager Julie Menack to Navy BEC Keith Forman.

Mr. Keith Forman

- 5 -

- Share their legal argument/opinion with our legal staff as to why CTR criteria are not applicable to near-shore groundwater contaminant plumes that discharge to the Bay.

If you have any question, please contact me at (510) 622-2492 or via e-mail at [jponton @waterboards.ca.gov](mailto:jponton@waterboards.ca.gov).

Sincerely,

James D. Ponton, P.G.
Project Manger

Attachment 1: Surface Water and Groundwater Screening Levels, Federal Sites

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SUBJECT: NAVY'S POSITION ON ISSUES RELATING TO THE PARCEL B TMSRA

Dear Team Members:

This letter summarizes the Navy's position on several issues prior to issuing the draft final Technical Memorandum in support of a Record of Decision (ROD) amendment (TMSRA) for Parcel B at Hunters Point Shipyard (HPS). The following issues have been discussed at several BRAC Cleanup Team (BCT) meetings and are addressed in this letter:

- Groundwater monitoring
- Methane
- Seawalls
- Vapor intrusion

Groundwater Monitoring

The Navy's proposals for groundwater monitoring in the draft final TMSRA will be based on potential human health and ecological risk. Monitoring will be intended to track: (1) potential migration of plumes toward San Francisco Bay or into uncontaminated areas, (2) changes in concentration within a plume, and (3) individual wells in areas found to pose potentially unacceptable risk. The TMSRA proposes a list of wells to be monitored as a vehicle for estimating the associated costs. The ROD amendment will state that groundwater monitoring will be a component of the remedy; however, individual wells will not be listed. Instead, the groundwater monitoring plan

will be developed as part of the remedial design and the initial individual wells and analytes will be chosen at that time.

The groundwater monitoring plan developed in the remedial design will include strategies from the U.S. Environmental Protection Agency's (EPA) Triad approach. Dynamic work strategies (one of the three central Triad concepts) incorporate the flexibility to change or adapt to new information. As information is gathered, it will be used by the BCT to best tailor future groundwater monitoring. The Navy envisions an adaptable program, where wells and analytes will be easily added or removed as necessary. The Navy will work closely with the BCT during development of the groundwater monitoring plan.

In the interim, the groundwater data will be reviewed to optimize the current remedial action monitoring plan. Optimization will be based on the Triad approach similar to the basewide sampling and analysis plan. Recommendations for changes will be proposed prior to the October-December 2007 sampling event. The Navy will convene a groundwater working group meeting in July to discuss proposed changes to the basewide groundwater monitoring plan.

Methane

Methane was detected in one area during a comprehensive survey of Installation Restoration (IR) Sites 07 and 18 completed in 2005. Wood construction debris at or below the water table is a suspected source of methane, based on wood encountered during remedial action excavations. The Navy has proposed to remove the methane source material by excavating the source area, to bedrock if necessary. Per our ARARs analysis, cleanup standards for methane at landfill sites, although not applicable, are relevant and appropriate to the methane source area at IR-07. In the TMSRA, the Navy accepts the substantive provisions of the regulations at Title 27 of the California Code of Regulations, Section 20921(a)(1) and (2), as relevant and appropriate requirements. The Navy did consider other guidance; however, state criteria designed for school sites, day care centers, and other sensitive uses are not applicable, relevant, or appropriate. Per the City of San Francisco's latest guidance, the anticipated future use of this site is open space. The 27 CCR 20921 regulations list methane cleanup standards as 1.25 percent methane (by volume in air) in on-site structures and 5 percent methane at the site boundary. Consistent with our discussions at the April 24 BCT meeting, the Navy will use 1.25 percent methane in on-site structures in the draft final TMSRA as the remedial action objective. As discussed later in this letter, the methane source area will be subject to a soil gas survey after remediation is completed to demonstrate the source removal was successful.

Seawalls

The shoreline of Parcel B includes sections at IR-07 and IR-26 that are beach sediment with varying amounts of riprap and a central section between IR-07 and IR-26 that is a wooden/concrete seawall. The screening-level ecological risk assessment completed using samples from the IR-07 and IR-26 shorelines found potential unacceptable risk to ecological receptors from the shoreline sediment caused by Navy releases. All remediation alternatives for soil (except no action) in the draft TMSRA include a shoreline revetment along all of the IR-07 and IR-26 shoreline to prevent exposure of ecological receptors to sediment. However, the Navy does not propose to include long-term maintenance of the seawalls as part of the remedy in the upcoming ROD amendment. The following paragraphs provide more detail to describe this position.

Seawalls are part of the HPS infrastructure and meet the San Francisco Bay Water Control Board's requirements for best management practices to minimize shoreline erosion and release of sediment into San Francisco Bay. The seawalls minimize erosion, but are not designed to be impervious to sediment migration. Furthermore, the material on both the landward and seaward sides of the seawall at Parcel B is similar, based on the method the Navy used to construct the fill at HPS. Artificial fill, composed mainly of broken rock from the upland bedrock areas at HPS, was pushed into the bay in the 1940s to create the flat-lying areas in the central portion of Parcel B. The seawall was installed into the fill and, therefore, similar material exists on both sides of the seawall. Ecological receptors have been in contact with the artificial fill since the land area at Parcel B was expanded in the 1940s. Any erosion of bedrock-derived fill is not expected to cause a significant change in the concentrations of dissolved constituents in the bay water because the bay water is already in equilibrium with the fill material.

The Navy has removed chemicals that resulted from spills and releases on the landward side of the seawall at Parcel B. The Navy removed about 8,000 cubic yards of soil from 13 excavations along or near the seawall during remedial actions in 1998 to 2001. The Navy also removed about 10,000 cubic yards of soil from two other excavations to remove petroleum-related contaminants in 2005. The excavations in 2005 removed soil to 10 feet or more below ground surface along more than 500 feet of the 1,700 feet of the central seawall at Parcel B.

Soils on the landward side of the seawall consist of (1) clean fill brought in from off site to backfill excavations, and (2) fill from the original expansion of HPS that contains metals that are ubiquitous throughout Parcel B and that are directly related to the

source bedrock. The Navy's position is that the concentrations of metals found in the Franciscan Formation bedrock and the bedrock-derived fill at HPS are similar to concentrations found elsewhere on the San Francisco peninsula. The Navy studied the ambient concentrations of metals in bedrock and bedrock-derived soil from three non-industrial sites in San Francisco with a geologic setting similar to HPS (Tetra Tech EM Inc. and Innovative Technical Solutions, Inc. 2004. Metals Concentrations in Franciscan Bedrock Outcrops: Three Sites in the Hunters Point Shear Zone and Marin Headlands Terrane Subunits, Hunters Point Shipyard, San Francisco, California.) The study found the chemical composition of soil at the three sites held similar concentrations of metals. Requiring long-term maintenance of the seawall to protect ecological receptors from exposure to these metals is inconsistent with the fact that other San Francisco bayside locations have a similar fill/surface water contact. None of these locations have seawalls (or other structures) intended to protect ecological receptors. Further, neither the intended function nor the structure of the seawalls is consistent with this goal.

Finally, the leading edge of the protective cap is not synonymous with the edge of the seawall. The leading edge is inherently part of the cap, and therefore, if selected as the remedy, it must be maintained. The Navy will work with the BCT to ensure that this is addressed in the ROD amendment.

Vapor Intrusion

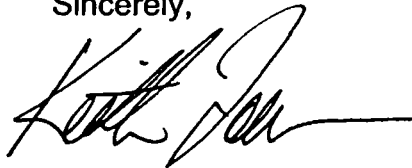
The Navy proposes to address potential issues related to vapor intrusion by collecting site-specific soil gas samples after remediation is complete to demonstrate that the remedy is operating properly and successfully. Sampling at an earlier stage in the cleanup process would not be useful because soil gas concentrations are expected to change over time as a result of remediation as well as natural degradation processes. The draft ROD amendment will state that institutional controls to address vapor intrusion will likely be a necessary component of the remedy, but that specific areas requiring institutional controls (ARIC) will be selected after remediation is complete. The results of the site-specific soil gas survey will be the basis for the ARICs. The soil gas survey will address both soil and groundwater areas where vapor intrusion is a concern. In accordance with recent discussions with the BCT, the draft final TMSRA will not discuss estimating vapor intrusion risk using bulk soil concentration data.

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Summary

The Navy will continue to work closely with the BCT during preparation of the Proposed Plan that will precede the ROD amendment. We are open to further discussion of issues which must be resolved in the ROD amendment but we also believe that the draft final TMSRA should be issued without further delay. Should you have any concerns, please contact me at (619) 532-0913.

Sincerely,



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By direction of the Director

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E-mail/Positions for Draft Final Parcel B TMSRA

APPENDIX H
CHROMIUM VI INVESTIGATION REPORT

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ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
Bay	San Francisco Bay
bgs	Below ground surface
DO	Dissolved oxygen
EPA	U.S. Environmental Protection Agency
HPS	Hunters Point Shipyard
IR	Installation Restoration
IR-10	Installation Restoration Site 10
IT Corp.	International Technology Corporation
mg/kg	Milligram per kilogram
Navy	U.S. Department of the Navy
ORP	Oxidation-reduction potential
RAMP	Remedial action monitoring plan
RI	Remedial investigation
SAP	Sampling and analysis plan
SVE	Soil vapor extraction
Tetra Tech	Tetra Tech EM Inc.
VOC	Volatile organic compound

EXECUTIVE SUMMARY

Hexavalent chromium has been detected in groundwater samples collected from monitoring well IR10MW12A. This well was installed in 1989 in the central portion of Parcel B in Hunters Point Shipyard, about 15 feet from Building 123, the Battery and Electroplating Shop. The well is screened in Artificial Fill (A-aquifer), about 450 feet from San Francisco Bay (Bay), and the well is sampled quarterly for hexavalent chromium as part of the remedial action monitoring program (RAMP) at Parcel B. The maximum concentration of hexavalent chromium detected in groundwater from this well was 1,680 micrograms per liter ($\mu\text{g/L}$), detected in 1994. During 2002, hexavalent chromium concentrations in samples collected from this well ranged from 380 $\mu\text{g/L}$ to nondetected (at a reporting limit of 10 $\mu\text{g/L}$) in the most recent sample collected (November). The aquatic criterion for hexavalent chromium is 50 $\mu\text{g/L}$, which would be applied to groundwater at the point of compliance or other entry points to the Bay.

Ten temporary wells were installed down-, cross-, and upgradient of well IR10MW12A, including inside the building near potential source(s) and outside the building near the utility and storm drain lines, for the following purposes:

- Identify the sources of hexavalent chromium
- Delineate the extent of hexavalent chromium in groundwater
- Evaluate site conditions

The wells were purged, sampled, and analyzed for total and hexavalent chromium and for oxidation-reduction indicator parameters. Chromium was not detected in any of the temporary wells.

The lithologic logs for borings in the area show that soil surrounding monitoring well IR10MW12A is made up of Artificial Fill, with clay derived from both Bay Mud and bedrock. Hexavalent chromium may have been spilled from the wooden loading dock and ramp outside of Building 123 and settled into gravel that had been placed in the area for building construction. Low-conductivity clay in the Artificial Fill may act as a physical and chemical barrier to migration of hexavalent chromium from the gravel repository.

The U.S. Department of the Navy recommends that monitoring well IR10MW12A continue to be monitored quarterly for hexavalent chromium during Year 4 of the RAMP in 2003. Because the Year 3 concentration trend for hexavalent chromium in the well is a decreasing one, and hexavalent chromium does not appear to be migrating toward the Bay, no active remediation of the suspected source is recommended.

H1.0 INTRODUCTION

This document presents the results of the investigation of hexavalent chromium in groundwater near Building 123, the former Electroplating and Battery Shop, in Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California. This document is organized as follows:

- Section H2.0, Project Description, discusses the purpose of the investigation and describes the site conditions, including the layout and history of Building 123 and the geology and hydrogeology of the study area.
- Section H3.0, Previous Investigations, discusses the results of previous groundwater, soil, and wipe sample analyses in the study area.
- Section H4.0, Hexavalent Chromium Hydrogeochemistry and Regulatory Criterion, summarizes background material on the origin, fate, and transport of hexavalent chromium in the environment and the regulatory criterion established for hexavalent chromium.
- Section H5.0, Data Collection, discusses the locations and installation of temporary wells and presents the laboratory and field data.
- Section H6.0, Data Evaluation, discusses the potential source(s), extent in groundwater, fate and transport, and concentration trends of hexavalent chromium in the study area.
- Section H7.0, Conclusions and Recommendations, summarizes the findings of the investigation and presents recommendations.
- Section H8.0, References, lists all references used to prepare this document and that are cited in the text.

Figures and tables are included directly after their first mention in the text of this document. Appendix H1, which contains boring logs from the study area, follows Section H8.0.

H2.0 PROJECT DESCRIPTION

Section H2.1 summarizes the purpose of the hexavalent chromium groundwater investigation. Section H2.2 describes the site, including the historical background of Building 123 near monitoring well IR10MW12A, and discusses the geology and hydrogeology of the study area.

H2.1 PURPOSE OF THE INVESTIGATION

In 1989, the U.S. Department of the Navy (Navy) installed monitoring well IR10MW12A in Installation Restoration (IR) Site 10 (IR-10) located in the central portion of Parcel B in HPS, about 15 feet from the western side of Building 123, the former Battery and Electroplating Shop (see Figures H-1 and H-2). Hexavalent chromium concentrations in groundwater samples collected from this monitoring well range from not detected (at a reporting limit of 10 micrograms per liter [$\mu\text{g/L}$]) to 1,680 $\mu\text{g/L}$ (see Figure H-3); hexavalent chromium was not detected in groundwater at any other location in central Parcel B. The Navy conducted a detailed investigation around well IR10MW12A in September 2002 to (1) identify the source(s) of hexavalent chromium, (2) delineate the extent of hexavalent chromium in groundwater, (3) evaluate site conditions, and (4) recommend possible future actions for hexavalent chromium in groundwater in central Parcel B.

H2.2 SITE DESCRIPTION

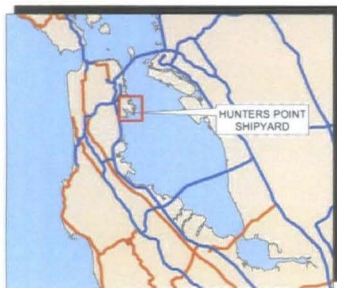
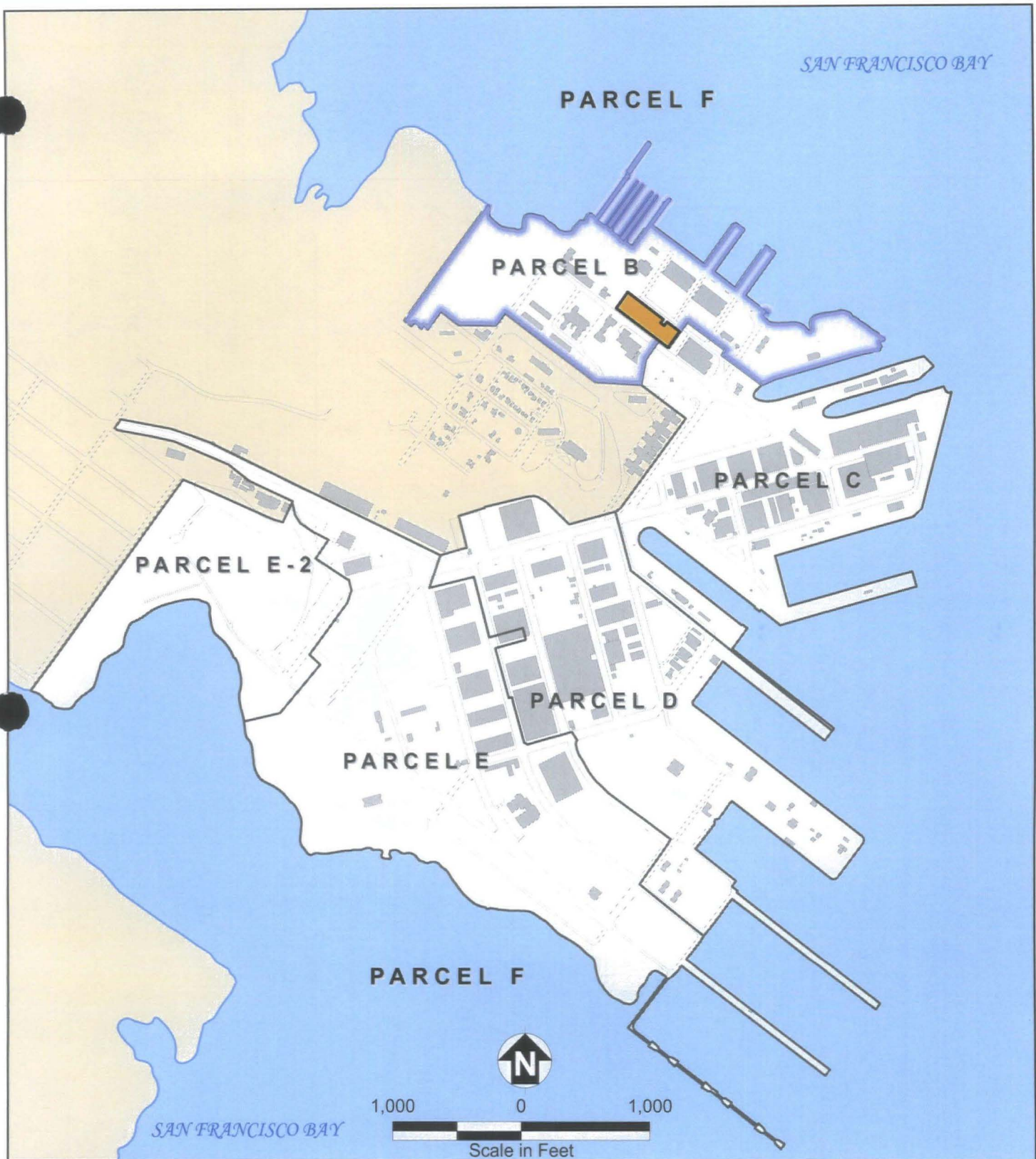
Section H2.2.1 presents information about Building 123, which is likely to be the source of hexavalent chromium detected in groundwater at well IR10MW12A. Section H2.2.2 describes the geology and hydrogeology in the investigation area (central Parcel B).

H2.2.1 Building 123

Building 123 is a large (over 77,000 square feet) one-story wooden building. From 1944 to 1974, the Navy used this building for overhauling and storing submarine batteries and as an electroplating shop (PRC Environmental Management, Inc. 1996). Electroplating operations were carried out in a suite of rooms in the northern corner of the building (see Figure H-4); rooms in this area are identified as the electroplating room (Room 105), the acid tank room (Room 104), the laboratory (Room 102), and the spray room (Room 125). During 2002, Shaw Environmental & Infrastructure, Inc., formerly International Technology Corporation (IT Corp.), decontaminated the tanks and drain lines remaining in this area.

In the battery shop, waste acids contaminated with lead and copper are presumed to have spilled onto the shop floor during the 30 years of operation. The waste acids drained into floor drains connected to the sewer system, which discharges into San Francisco Bay (Bay). Similarly, in the electroplating shop, spent electrolyte solution containing chromium, copper, lead, and tin are presumed to have spilled onto the shop floor and discharged to the storm sewer (WESTEC, Inc. 1984). Cyanide wastes were also generated, but were disposed of separately in containers and transported to the landfill in Parcel E.

A network of utility lines served the northwestern portion of Building 123, as shown on Figure H-4. The supply lines ran above grade underneath the building floor and at a depth of about 4 to 6 feet below ground surface (bgs) around the outside of the building. Freshwater lines encircle the northwest corner of the building.



Location Map

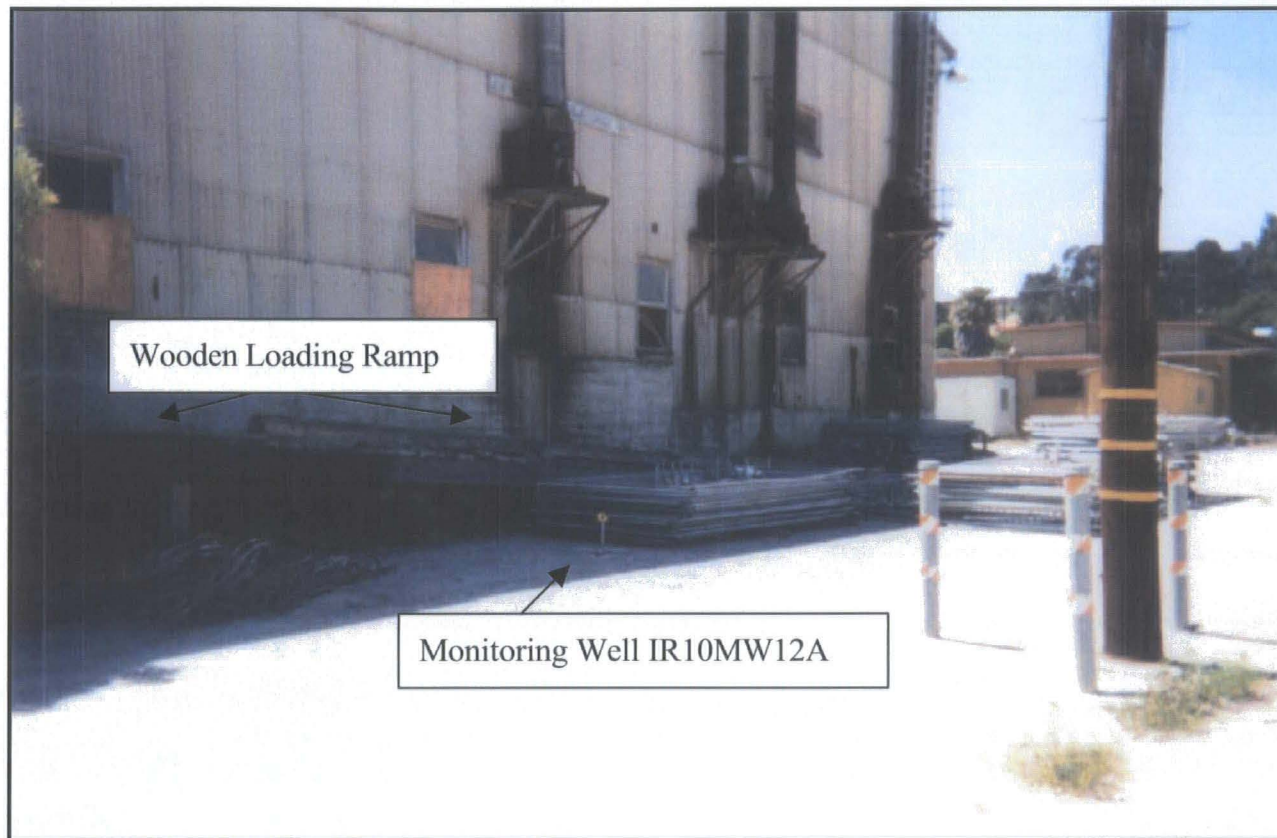
- Building 123
- Parcel B Boundary
- Parcel Boundary
- Building
- Non-Navy Property
- Road



Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE H-1
BUILDING 123 LOCATION MAP

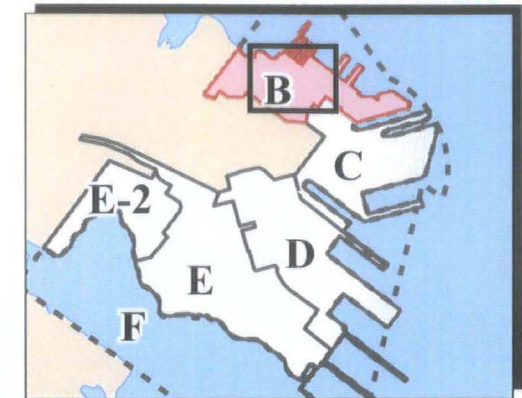
TMSRA for Parcel B



Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

**FIGURE H-2
PHOTOGRAPH OF
MONITORING WELL IR10MW12A**

TMSRA for Parcel B



Location Map

- Parcel B Wells with Hexavalent Chromium Result
- Monitoring Well Sampled for Hexavalent Chromium in October 2001 Study
- Parcel B Monitoring Well with on Hexavalent Chromium Result
- Inferred Groundwater Flow Direction
- Road
- Parcel Boundary
- Building
- San Francisco Bay

Notes:
All concentrations in micrograms per liter.
ND - Not detected at the associated reporting limit



0 120 240
Scale in Feet

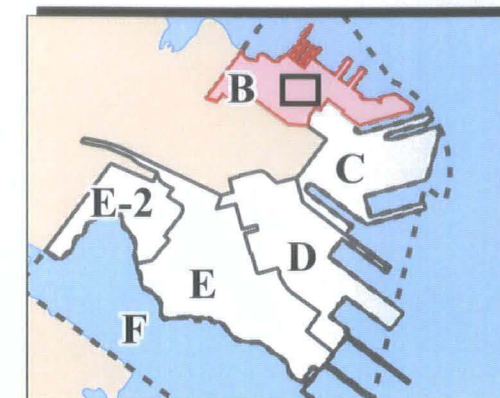
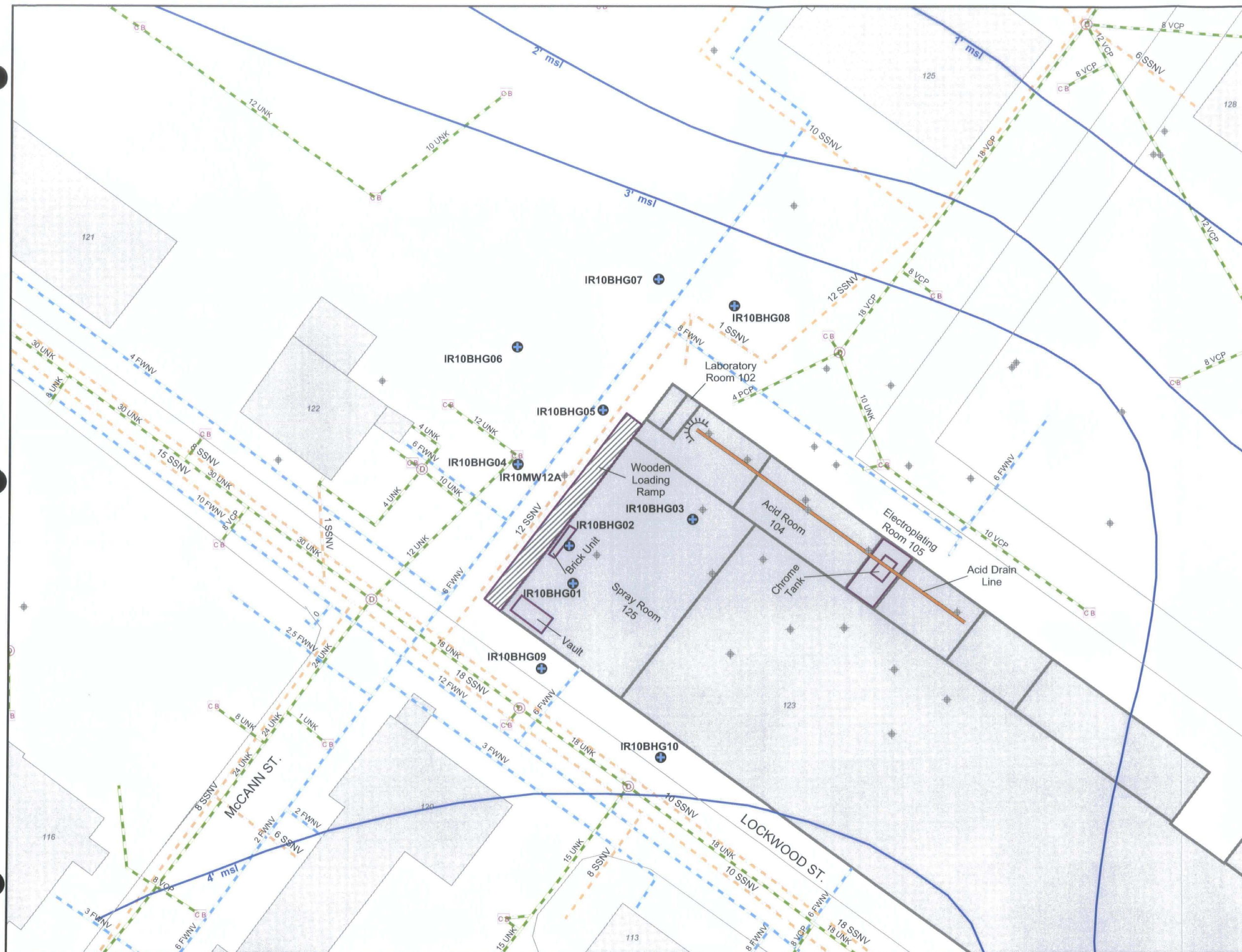


Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE H-3
HISTORICAL CONCENTRATIONS OF
HEXAVALENT CHROMIUM IN
GROUNDWATER CENTRAL PARCEL B

TMSRA for Parcel B

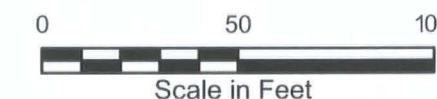
IR10MW12A	
Date	Concentration
3/9/1989	400
3/13/1989	400
8/21/1990	160
7/12/1991	180
1/15/1992	ND (10)
11/9/1993	528
2/17/1994	960
5/12/1994	1680
8/30/1994	1260
7/19/2001	270
10/8/2001	110
3/13/2002	380
5/30/2002	160
8/29/2002	60
11/12/2002	ND (10)



Location Map

- + Temporary Well
- CB Catch Basin
- D Man Hole
- + HPS Monitoring Well
- Water Level (Feb. 2001)
- Storm Sewer
- Sanitary Sewer
- Fresh Water Pipe
- Road
- Building

Note: Results for hexavalent chromium and total chromium in all temporary monitoring wells were not detected, at a reporting limit of 10 micrograms per liter.



Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

**FIGURE H-4
TEMPORARY MONITORING WELL
LOCATIONS AT IR-10**

TMSRA for Parcel B

Sanitary sewer lines drain out of the northwestern corner of the building in two directions: (1) northeast toward the Bay and (2) southwest along the short side of the building, until connecting with the line running behind the building under Lockwood Street. A 4-inch acid drain line runs under the electroplating and acid tank rooms at an undetermined depth.

Connecting drains from Building 123 to the industrial drain line located in Lockwood Street were made of vitrified clay pipe; the extensions of these drains beneath Building 123 are possibly of similar composition. Drains in Building 123 have been inspected, cleaned, flushed, and then grouted in place with the associated cleared piping. Debris was also removed from trenches leading to the acid drain line system, and the trenches were steam-cleaned. The most recent of these waste consolidation activities were performed in 2002 (IT Corp. 2002).

A storm sewer system network between Building 123 and Building 122 in IR-61 drains the open area northwest of Building 123; the closest storm drain line to monitoring well IR10MW12A is about 25 feet away. These drains feed into a larger storm drain line (18-inch diameter) running along Lockwood Street, parallel to the utility lines. During 1994 and 2002, the Navy conducted a geographical information system analysis of HPS storm drain, sewer, and fuel lines. Results of the analysis indicated that storm drain and sanitary sewer lines in this area were both below and above groundwater levels. The length of storm drain that runs parallel to the western side of the building, where well IR10MW12A is located, is set at a bottom-of-the-pipe depth of about 4 feet bgs on the northern end, sloping to about 8 feet bgs at the intersection of McCann and Lockwood Streets. The pipe was most likely laid in a gravel bed about 1 foot thick.

The following potential sources of hexavalent chromium in well IR10MW12A are located outside and inside Building 123 (see Figure H-4):

1. Loading Ramp. A heavy wooden loading ramp is outside the western side of the building; monitoring well IR10MW12A is located a few feet from this ramp (see Figure H-2). The source of hexavalent chromium in this case would be a spill or spills that occurred during loading and unloading operations. There is no indication that tanks were located outside the building on the western sides.
2. Concrete Vault. A 27-by-11-foot wide and 7-feet-deep concrete vault constructed below grade and flush with the shop floor is located in the southwestern corner inside the building. A drainage hole is on the floor of the vault in the northeastern corner; it probably drained directly to the storm drains outside the building. The vault may have held a dip tank that contained solvents or plating solutions.
3. Tank/Acid Drain Line. The acid drain line runs westward from the electroplating tank inside Room 105, at an unknown depth.
4. Brick Unit. A long, narrow rectangular brick structure that is about 2 feet high, 3 feet wide, and 18 feet long is located near the western wall inside Building 123, about 17 feet from well IR10MW12A. The structure was used for dipping large steel plates. The bottom of the structure is concrete, with a crack running through it. Racks suspended in front of this structure were used when the plates were sprayed with zinc chromate primer.

H2.2.2 Geology and Hydrogeology

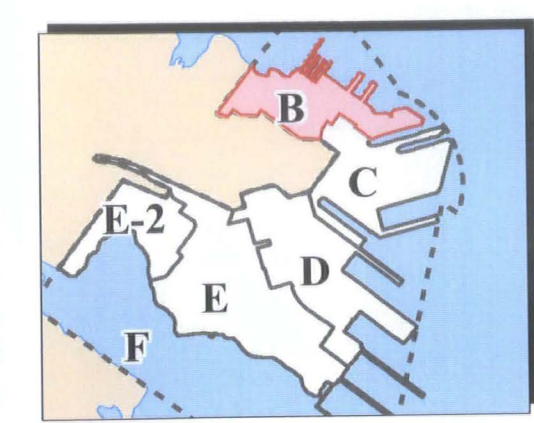
Building 123 was built on top of the heterogeneous material brought in to fill the Bay near HPS. The fill material at HPS is usually made up of serpentinite-derived gravels and sand; however, as shown on boring logs included in Appendix H1, fill material in this area also contains a sandy and silty clay. This clay appears to contain both organic and inorganic components resulting from Bay Mud and weathered serpentinite bedrock, respectively.

The fill material reaches a maximum depth of about 40 to 50 feet bgs under Building 123, along the northeastern side, and overlies about 20 to 30 feet of Bay Mud and alluvial deposits, which overlie serpentinite bedrock (Dames and Moore 1943a, 1943b).

The water-bearing zone on the western side of Building 123 is made up of both the unconfined A-aquifer and the semiconfined or confined B-aquifer, which lies directly underneath the A-aquifer in this area; in other areas in Parcel B, the B-aquifer is separated from the A-aquifer by an aquitard of fine-grained Bay Mud material. The A-aquifer in Parcel B is made up of the heterogeneous fill material and, in some places, undifferentiated upper sands (that is, estuarine and alluvial sands overlying or interbedded with Bay Mud). The Artificial Fill material ranges in thickness from about 5 to 85 feet, increasing toward the Bay; the undifferentiated upper sands range in thickness from 0 to about 15 feet. The B-aquifer is made up of coarse-grained materials interbedded with clays and silts. The B-aquifer ranges from 0 to about 45 feet thick, and is thicker in the western and central portions of Parcel B.

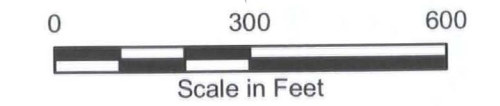
Monitoring well IR10MW12A, located about 15 feet west of Building 123, is screened from 3 to 18 feet bgs in silty gravel of the A-aquifer. The well is about 450 feet from the Bay. Groundwater flows primarily to the north in this area, but flows northeast as it moves closer to the Bay, as shown on Figure H-5. Groundwater elevations are measured quarterly in about 60 Parcel B wells as part of the remedial action monitoring plan (RAMP) program (Tetra Tech EM Inc. [Tetra Tech] 2003a).

Utility and storm drain lines in this area were laid in gravel beds. These lines are old and potentially leaky; therefore, they have the potential to act as preferential pathways for chemicals released in the study area. It would be more likely for the storm drain lines to serve as preferential pathways than for the utility lines, since the storm drain lines are deeper. Sections of both lines have been found to be below groundwater levels (see Section H2.2.1). However, the quarterly RAMP groundwater elevation contour maps (see Figures 3, 4, 5, and 6 from the annual groundwater sampling report [Tetra Tech 2003a]) show no depressions near western Building 123 caused by leaking storm drain or sanitary sewer lines, or by their gravel beds.



Location Map

- Well Identification with Groundwater Elevation (August 27, 2002) (feet above mean sea level, NGVD 1929)
- A-Aquifer Monitoring Well
 - A-Aquifer Groundwater Elevation Contour
 - ➔ Inferred Groundwater Flow Direction
 - ▬ Seawall
 - Road
 - ▭ Building
 - ▭ Parcel B Boundary
 - ▭ Other Parcel Boundary
 - San Francisco Bay
 - Non-Navy Property
 - NGVD National Geodetic Vertical Datum



Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

FIGURE H-5
A-AQUIFER GROUNDWATER ELEVATION
CONTOUR MAP,
AUGUST 27, 2002
TMSRA for Parcel B

H3.0 PREVIOUS INVESTIGATIONS

This section discusses previous data collected in the investigation area, including groundwater samples collected from monitoring wells in the central portion of Parcel B (see Section H3.1) and wipe samples collected during 2002 inside of Building 123 (see Section H3.2); wipe samples were collected during decontamination of the plating tanks and drains that remain in the northwestern corner of the building. Section H3.3 discusses soil samples collected in IR-10 during the IR Program in 1988 and 1989 and during the remedial investigation (RI) in 1995.

H3.1 GROUNDWATER SAMPLES

Between 1989 and 1994, the Navy sampled monitoring well IR10MW12A for hexavalent chromium eight times, and hexavalent chromium sampling for this well was added to the RAMP program in the eighth quarter. Hexavalent chromium concentrations in this well ranged from a maximum of 1,680 µg/L (1994) to nondetect (at a reporting limit of 10 µg/L) during the twelfth quarter sampling event in November 2002 (Tetra Tech 2003a). Figure H-3 shows the historical results for hexavalent chromium in this well. Concentration trends do not appear to show a correlation with the dry and wet seasons. Total chromium concentrations historically detected at well IR10MW12A have been similar to the hexavalent chromium concentrations; therefore, total chromium detected at this well is almost entirely hexavalent rather than trivalent chromium.

Hexavalent chromium has not been detected in any other monitoring well in central Parcel B. Figure H-3 shows the locations of all monitoring wells in central Parcel B and the maximum reporting limits for each well; most of the wells have been sampled for hexavalent chromium three or more times. In October 2001, the Navy collected groundwater samples from six downgradient and crossgradient wells (see Figure H-3). The samples were analyzed for total and hexavalent chromium to aid in characterizing chromium in the area surrounding well IR10MW12A. Total and hexavalent chromium were not detected, at a reporting limit of 10 µg/L, except at well IR10MW12A.

From December 2000 to March 2002, the Navy operated a soil vapor extraction (SVE) system in the northwestern portion of Building 123. The Navy monitored well IR10MW12A quarterly during Years 1, 2, and 3 of the RAMP program for chlorinated volatile organic compounds (VOC); however, no VOCs were detected in this well. The maximum concentration (410 µg/L) of trichloroethene detected in IR-10 during the RAMP (in November 2002) was in well IR10MW59A (location shown on Figure H-3).

H3.2 WIPE SAMPLES

During April and May 2002, dip tanks, hoods, and drain lines in the electroplating room (Room 105) and the acid tank room (Room 104) on the northwest side of Building 123 were decontaminated. Wipe samples were collected from the exhaust ducts in these rooms and analyzed for the standard suite of metals, including hexavalent chromium, by APC Laboratories in Chino, California. Wipe samples were also collected from walls and duct openings in the

spray room (Room 125) and the laboratory (Room 102) on the west side of Building 123. The brick unit and the concrete vault, previously identified as potential sources of hexavalent chromium, are located in the spray room (see Figure H-5).

Hexavalent chromium was detected on the wipe sample collected from the duct adjacent and north of the brick containment unit at 996 micrograms; less than 20 micrograms of hexavalent chromium was detected on the wipe samples collected from the brick unit itself and from other exhaust ducts in the spray room and electroplating room. These results indicate that the brick unit contained hexavalent chromium, and is likely a potential source of the hexavalent chromium observed in well IR10MW12A.

H3.3 SOIL SAMPLES

Soil samples from borings in IR-10 were analyzed for total and hexavalent chromium during the IR Program in 1988 and 1989 and the RI in 1995. The concentrations of total chromium detected in soils from boring IR10MW12A ranged from 360 to 570 milligrams per kilogram (mg/kg). The Parcel B RI report (PRC Environmental Management, Inc. 1996) noted that the concentrations of total chromium in IR-10 soils did not indicate distributions significantly different from the distribution of chromium in fill material throughout Parcel B.

Hexavalent chromium was detected in only one soil sample in IR-10, at a concentration of 0.2 mg/kg. The sample was collected at 5.75 feet bgs from boring IR10MW13A2 (see Figure H-3) in 1988. A soil sample was collected at 7.75 feet bgs from this boring, but was not analyzed for hexavalent chromium; hexavalent chromium was not detected (at a reporting limit of 0.1 mg/kg) in the samples collected at 0.75 and 2.75 feet bgs. Total chromium was detected at concentrations ranging from 160 to 821 mg/kg in these soil samples; however, as noted in the preceding paragraph, these concentrations are consistent with the levels found throughout Parcel B. The well (IR10MW13A2) subsequently installed in the boring is screened from 25 to 40 feet bgs, much deeper than the soil sample with the detected result for hexavalent chromium. However, well IR10MW13A1, which was installed nearby at the same time, is screened from 5 to 20 feet bgs. Groundwater samples from well IR10MW13A1 were collected and analyzed for hexavalent chromium once a year in 1989 through 1993, three times in 1994, and once in 2001; hexavalent chromium was not detected (at a reporting limit of 50 µg/L in 1989 and at 10 µg/L at all other dates) in any of the samples.

Boring IR10MW13A2 is located about 30 feet from a freshwater line and about 80 feet from storm drains on the northern side of Building 123. The source of hexavalent chromium detected in the soil sample cannot be determined; however, there is no indication that it is related to hexavalent chromium detected at well IR10MW12A, about 260 feet to the southwest. It is possible that the detection represents a localized condition favorable to the oxidation of total chromium. The isolated detection and the low concentration, in addition to the nondetected results for hexavalent chromium in groundwater at well IR10MW13A1, do not indicate a potential threat to the environment.

H4.0 HEXAVALENT CHROMIUM HYDROGEOCHEMISTRY AND REGULATORY CRITERION

This section presents general information taken from literature on the geochemistry and the oxidation-reduction chemistry of hexavalent chromium (see Section H4.1) and its regulatory criterion in saltwater (see Section H4.2).

H4.1 HYDROGEOCHEMISTRY

Chromium is most frequently found in the environment in the +3 oxidation state (trivalent chromium or chromium III); the +6 oxidation state (hexavalent chromium or chromium VI) is usually an indicator of industrial activity. Hexavalent chromium tends to be soluble and therefore very mobile in the environment. Trivalent chromium, which is relatively nontoxic, tends to precipitate out and adsorb to soil particles; therefore, it is immobile in the environment (U.S. Environmental Protection Agency [EPA] 1994).

Hexavalent chromium exists in soils as negatively charged chromate and dichromate ions (CrO_4^{2-} and $\text{Cr}_2\text{O}_7^{2-}$); as a result, it is found on positively charged sites on soil particles. Since the number of positive sites (usually iron and aluminum oxide surfaces) decreases with increasing pH, hexavalent chromium tends to be mobile at pH greater than 7. Moderate amounts of multivalent anions such as sulfate and phosphate can inhibit the adsorption of the chromate ions onto the soil surfaces; monovalent anions such as chloride and nitrate have little effect. Although hexavalent chromium is usually very mobile in soils, including alkaline soils, its migration can be significantly slowed by adsorption onto soil particles in soils that are high in iron and aluminum oxides or by reduction in clay soils that contain free iron and manganese oxides (EPA 1999). Iron and manganese are commonly measured in groundwater in natural attenuation studies as soluble ferrous iron (Fe II) and divalent manganese (manganese II); the reduction of hexavalent chromium results in insoluble ferric iron (Fe III) and manganese (IV) oxides.

Hexavalent chromium can be reduced to trivalent chromium under normal soil pH and oxidation-reduction conditions, using soil organic matter, dissolved sulfides, or ferrous iron (found in magnetites in basalt and chert) as the electron donor. The reduction reaction in the presence of organic matter, which is probably the primary reducing agent in surface soils, proceeds at a slow rate at environmental pH and temperatures, and increases with decreasing soil pH; it may require years in natural soils (EPA 1999). The oxidation of trivalent chromium to hexavalent chromium has been observed in soils in the presence of oxidized manganese (manganese IV or MnO_2); in batch tests, this process has been observed to take place over several months (EPA 1994). Trivalent chromium can also be oxidized by dissolved oxygen (DO), although this is less likely to be an important mechanism (EPA 1994). Trivalent chromium can also be found in groundwater when organic complexed trivalent chromium associated with industrial uses of chromium can complex with soluble organic ligands and remain in solution in soils (EPA 1999).

Hexavalent chromium can be introduced into the environment by completely natural processes. For example, trivalent chromium can be released from chromite-containing minerals in serpentinite by weathering and then oxidized to hexavalent chromium (Kent 2001). Although serpentinite is present at Parcel B, hexavalent chromium present at well IR10MW12A is most likely from manmade sources.

H4.2 REGULATORY CRITERION IN GROUNDWATER

The saltwater chronic, 4-day average criterion for hexavalent chromium is 50 µg/L (EPA 2002). This criterion would be applied to groundwater at the point of compliance or other entry points to the Bay (for example, at a storm drain outfall). Since groundwater at Parcel B has no beneficial use as a drinking water (Tetra Tech 1997), the drinking water criterion (also 50 µg/L) does not apply.

H5.0 DATA COLLECTION

Sections H5.1 and H5.2 discuss the locations of the temporary sampling locations and sample analyses and the field investigation. Sections H5.3 and H5.4 present the laboratory and field data tables.

H5.1 TEMPORARY SAMPLING LOCATIONS AND SAMPLE ANALYSES

In 2002, the Navy conducted the investigation described in this document to further refine and delineate the extent of hexavalent chromium in groundwater around monitoring well IR10MW12A. Samples were collected from 10 temporary wells located near the potential sources and at other upgradient, crossgradient, and downgradient locations (see Figure H-4), as listed in the table below.

Temporary Well	Well Type/ Rationale	Location	Approximate Distance from Well IR10MW12A (feet)
IR10BHG01	Potential Source	Near concrete vault	60
IR10BHG02	Potential Source	Near brick unit	40
IR10BHG03	Potential Source	Near acid drain line from electroplating room	70
IR10BHG04	Crossgradient	Near storm drain	25
IR10BHG05	Downgradient	Near utility lines	45
IR10BHG06	Downgradient	In open area	75
IR10BHG07	Downgradient	In open area	110
IR10BHG08	Downgradient	Near utility lines	125
IR10BHG09	Upgradient	South of concrete vault	100
IR10BHG10	Upgradient	Southeast of concrete vault	150

As noted in the sampling and analysis plan (SAP) (Tetra Tech 2002), groundwater samples were collected from the temporary wells for the following analyses at an off-site laboratory (Curtis & Tompkins, Ltd.):

- Hexavalent chromium
- Total (trivalent and hexavalent) chromium
- Alkalinity
- Anions (chloride, nitrate, nitrite, orthophosphate as phosphorus, and sulfate)

Groundwater from the temporary wells was analyzed in the field for the following well stabilization parameters:

- Temperature
- Specific conductivity
- DO
- pH
- Oxidation-reduction potential (ORP)

Groundwater samples collected from the temporary wells were also analyzed in the field for ferrous iron and manganese dioxide.

The measurements for alkalinity, anions, DO, ORP, ferrous iron, and manganese dioxide helped to interpret the oxidation-reduction conditions in the area.

Two soil samples were collected from boring IR10BHG02 near the brick unit at depths of 2 and 10 feet bgs (see Figure H-4); these samples were analyzed for hexavalent chromium and pH.

The analytical methods are listed in the SAP (Tetra Tech 2002).

H5.2 FIELD INVESTIGATION

The following sections summarize temporary monitoring well installation (see Section H5.2.1) and groundwater sampling activities (see Section H5.2.2) performed during the investigation of chromium at Building 123. Field activities were conducted in accordance with procedures presented in the SAP (Tetra Tech 2002) between September 10 and 16, 2002, when SVE confirmation study field activities were being conducted.

H5.2.1 Temporary Monitoring Well Installation

Ten temporary polyvinyl chloride groundwater monitoring wells were installed using Geoprobe® direct-push technology. The Geoprobe® drive-rods were advanced to a depth of about 3 feet below first-encountered groundwater, which ranged from 6 and 12 feet bgs. Once the drive-rods were driven to the appropriate depth, preconstructed monitoring wells were inserted through the drive-rods of the Geoprobe®. Once the well was inserted to the total depth of the boring, the drive-rods were removed, leaving the temporary monitoring well in place. The wells have been left in place, are accessible for future sampling activities, and are protected at the ground surface with traffic cones. Lithologic logs for each soil boring and monitoring well construction diagrams for each temporary monitoring well were entered into the HPS database and are presented in Appendix H1. Each temporary groundwater monitoring well location was surveyed, and the coordinates were entered into the database.

H5.2.2 Temporary Monitoring Well Groundwater Sampling

During September 2002, the Navy purged and sampled each of the 10 temporary groundwater monitoring wells in accordance with standard operating procedure No. 010 presented in the SAP (Tetra Tech 2002). The stabilization parameters, including temperature, specific conductivity, pH, DO, and ORP, were measured with a YSI 556 MPS flow-through cell water quality meter and recorded on well sampling sheets. Once water quality parameters were stable, groundwater samples for total and hexavalent chromium were collected in separate 1-liter polyethylene bottles and shipped to the off-site laboratory (Curtis & Tompkins, Ltd.) for analysis. Groundwater samples for total (trivalent and hexavalent) chromium were filtered in the field through a 0.45-micron filter. Groundwater samples for hexavalent chromium were not filtered in the field; samples for hexavalent chromium analysis are filtered in the laboratory as part of the routine sample preparation procedure for this analysis. Groundwater samples from each well were also analyzed in the field for ferrous iron and manganese dioxide using a Hach color disc field-test (Model IR-18C) and a Hach pocket colorimeter.

H5.3 LABORATORY DATA PRESENTATION

Table H-1 presents the results for groundwater samples analyzed for metals, alkalinity, and anions by the off-site laboratory. All of the data were validated in accordance with data validation guidelines for HPS (Tetra Tech 2001). Some results were estimated, and no results were rejected. All of the results for total and hexavalent chromium in groundwater samples collected from the temporary wells were nondetected at a reporting limit of 10 µg/L. Data validators qualified low concentration results for total chromium as nondetected (U1) for two groundwater samples, due to laboratory blank contamination.

Table H-1 also presents the results for two soil samples collected from boring IR10BHG02 at 2 and 10 feet bgs; these samples were analyzed for hexavalent chromium and pH by the off-site laboratory. Hexavalent chromium was not detected in either sample, at a reporting limit of 0.06 mg/kg.

TABLE H-1: LABORATORY ANALYTICAL RESULTS
Appendix H, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Sampling Location:	IR10BH601	IR10BHG02	IR10BHG03	IR10BHG04	IR10BHG05	IR10BHG06	IR10BHG07	IR10BHG08	IR10BHG09	IR10BHG09 (Field Duplicate)	IR10BHG10	IR10BHG02 (2 feet bgs)	IR10BHG02 (10 feet bgs)
Matrix: Water (µg/L)													
Metals													
Hexavalent Chromium	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	---	---
Total Chromium	10 U	10 U	10 U	10 U1	10 U1	10 U	10 U	10 U	10 U	10 U	10 U	---	---
Alkalinity													
Alkalinity, Total (as CaCO ₃)	240,000	280,000	390,000	370,000	250,000	230,000	41,000	85,000	490,000	390,000	360,000	---	---
Bicarbonate	240,000	280,000	390,000	370,000	250,000	230,000	35,000	77,000	490,000	390,000	360,000	---	---
Carbonate	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	5,500	7,400	1,000 U	1,000 U	1,000 U	---	---
Hydroxide (as CaCO ₃)	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	---	---
Anions													
Chloride	48,000	100,000	430,000	530,000	390,000	130,000	7,700	4,400	640,000	430,000	470,000	---	---
Nitrate	50 U	50 U	50 U	50 U	90	50 U	40 J	50 J	50 U	50 U	110	---	---
Nitrite	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	---	---
Orthophosphate (as phosphorus)	200 U	200 U	200 U	200 U	200 U	200 U	120 J	110 J	110 J	200 U	200 U	---	---
Sulfate	76,000	110,000	140,000	190,000	450,000	160,000	7,000	5,900	170,000	130,000	180,000	---	---
Matrix: Soil (mg/kg)													
Metals													
Hexavalent Chromium	---	---	---	---	---	---	---	---	---	---	---	0.06 U	0.06 U
pH													
pH	---	---	---	---	---	---	---	---	---	---	---	8.2	7.9

Notes:

---	Not applicable
µg/L	Micrograms per liter
bgs	Below ground surface
J	Estimated result
mg/kg	Milligrams per kilogram
U	Not detected
U1	Qualified as not detected due to blank contamination

H5.4 FIELD DATA PRESENTATION

Table H-2 presents the well stabilization, ferrous iron, and manganese dioxide data in groundwater samples collected in the field at each temporary well.

H6.0 DATA EVALUATION

This section summarizes the investigation results and other supporting data and information and discusses the potential sources of hexavalent chromium at IR10MW12A (see Section H6.1), its extent in groundwater (see Section H6.2), the possible fate and transport of hexavalent chromium in the investigation area (see Section H6.3), and the evaluation of concentration trends (see Section H6.4).

H6.1 POTENTIAL SOURCES

Data were collected during this investigation at three potential sources: the vault, the brick tank, and the acid drain line from the tank in Room 105. A temporary well was not installed near the fourth potential source—the loading ramp—because that is the location of well IR10MW12A. None of the three was implicated as the source of the hexavalent chromium in groundwater.

Although the brick tank had been identified as the most likely potential source, hexavalent chromium was not detected in water collected from temporary well IR10BHG02 (3 feet east of the unit) or in the soil sample collected from the temporary well boring at 2 and 10 feet bgs.

Hexavalent and total chromium were also not detected (at reporting limits of 10 µg/L) in the groundwater samples collected from temporary wells located near the two following other potential sources:

- Well IR10BHG01, located near the concrete vault in the corner of the building
- Well IR10BHG03, located between well IR10MW12A and the acid drain line that runs from the plating room

As a result, the fourth potential source—the wooden loading ramp—was implicated. The ramp is along the outside of Building 123, about 5 feet from well IR10MW12A. This well remains the only location with detected results for hexavalent chromium in groundwater at central Parcel B, and loading docks are common sites of spills. A larger spill of chromic acid may have occurred at one time or a number of smaller spills may have occurred during routine loading and unloading operations on the ramp.

TABLE H-2: FIELD MEASUREMENTS AND ANALYTICAL RESULTS, SEPTEMBER 16, 2002

Appendix H, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

			Parameter						
			Temperature (°C)	Specific Conductivity (mS/cm)	pH	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mv)	Ferrous Iron (mg/L)	Manganese II (mg/L)
Sampling Location	Depth to Water (feet below TOC)	Total Depth (feet bgs)	MATRIX: WATER						
IR10BHG01	12.84	17.1	16.84	0.574	7.48	5.65	96.5	0.2	0.7
IR10BHG02	13.14	16.9	16.43	0.867	7.25	1.28	75.4	0.3	0.7
IR10BHG03	12.81	17.1	16.33	1.784	7.66	1.39	77.8	0	0.5
IR10BHG04	6.34	12.4	18.83	1.886	7.63	5.15	65.1	0.2	1.9
IR10BHG05	6.03	12.1	20.28	0.785	8.21	3.92	122.5	0.4	0.5
IR10BHG06	6.58	11.4	20.97	1.032	7.74	0.29 ^a	83.7 ^a	0.5	0.3
IR10BHG07	3.99	12.0	21.55	0.107	8.46	2.9	112.1	0.6	11
IR10BHG08	4.79	10.4	21.73	0.085	8.19	4.5	101	0.2	1.9
IR10BHG09	7.64	12.0	19.81	2.847	7.22	5.35 ^a	-30.1 ^a	0.2	1.3
IR10BHG10	7.49	11.9	20.40	2.019	7.21	1.15	15.7	0.4	2.2

Notes:

a The data appear to be inconsistent; flow-through cell meter may have been calibrated improperly or malfunctioned.

bgs Below ground surface

mg/L Milligram per liter

mS/cm Millisiemen per centimeter

mv Millivolt

TOC Top of casing

H6.2

EXTENT IN GROUNDWATER

The nondetected results for hexavalent chromium detected during this investigation have further localized the extent of a potential "plume" of hexavalent chromium in groundwater around well IR10MW12A. The nondetected results in groundwater from the downgradient temporary wells (IR10BHG05, IR10BHG06, IR10BHG07, and IR10BHG08) demonstrate that it is unlikely that hexavalent chromium is being transported to the Bay through the fill material and sands of the A-aquifer.

Two crossgradient temporary wells, IR10BHG04 and IR10BHG02, have bounded the potential plume to within about 30 feet to the northwest and 30 feet to the northeast of monitoring well IR10MW12A.

Upgradient temporary wells IR10BHG09 and IR10BHG10 located behind (south) Building 123 have bounded the plume to the back of the building (southwestern side).

The Navy did not install crossgradient temporary wells in the area southwest of well IR10MW12A, where the wooden ramp slopes down to the ground.

H6.3

FATE AND TRANSPORT

The fate and transport of hexavalent chromium in the environment can be influenced by a complex variety of factors. The lack of detected results, both during this investigation and historically, in any monitoring wells in the area and out toward the Bay indicates that hexavalent chromium most likely has only a limited transport away from the area immediately surrounding well IR10MW12A.

Hexavalent chromium may have been nondetected in the temporary wells surrounding well IR10MW12A because of one of the following scenarios:

1. A preferential pathway for hexavalent chromium is not in the path of the temporary wells sampled during the investigation.
2. A physical barrier prevents the migration of hexavalent chromium from well IR10MW12A.
3. A chemical barrier reduces hexavalent chromium to trivalent chromium at a short distance from well IR10MW12A.

As noted in Section H2.2.2, the quarterly RAMP groundwater elevation contour maps have not shown any depressions that indicate groundwater in the area is following a preferential pathway, either through leaks in the storm drain or sanitary sewer lines or through their gravel beds (refer to Section H2.2.1 for a description of the storm drain and utility lines). Scenarios 2 and 3 are the most likely to occur based on historic and current data.

As noted in Section H2.2.2, the lithology of the borings for the temporary wells shows that the fill material has clay constituents, as do many of the boring logs for the monitoring wells previously installed in the area (see Appendix H1). The sandy, silty clay appears to be derived from both Bay Mud, which contains organic matter, and serpentinite bedrock, which is high in iron and manganese. The clay may be slowing the migration of hexavalent chromium by the following physical and chemical processes:

1. Groundwater has a limited migration through the porous fill material because of the low conductivity of the clay
2. Hexavalent chromium is likely reduced to trivalent chromium by the electron donors (the iron and manganese and organic matter) present in the clay
3. Fine-grained materials immobilize the reduced chromium by providing a large surface area for adsorption

The boring log for well IR10MW12A shows gravel, silt, and sand to the bottom of the boring at a depth of 20.5 feet bgs, but no clay (see Appendix H1). These coarse-grained materials may have been put in place during the construction of Building 123 and emplacement of the sanitary sewer and freshwater pipes (see Figure H-4). The permeable areas filled with these materials may be acting as a repository for the hexavalent chromium, with surrounding clay preventing its migration. Utility line corridors with gravel beds are most likely too shallow to act as preferential pathways for the migration of hexavalent chromium to outside areas. Farther to the west, clay may also prevent hexavalent chromium from reaching the deeper storm drain lines (bottom of the gravel bed is estimated at 8 to 9 feet bgs).

As shown in the following table, the oxidation-reduction results from groundwater samples collected from the temporary wells indicate that conditions at Building 123 are favorable for the reduction of hexavalent chromium to trivalent chromium, with high concentrations of manganese dioxide, ferrous iron, and DO.

Indicator Parameter	Level Found in Temporary Wells	Effect on Hexavalent Chromium Mobility at that Level
Alkalinity	Moderate (most wells)	(-)
Anions		
Chloride	Moderate to high	(0)
Nitrate/nitrite	Low	(0)
Orthophosphate (as phosphorus)	Moderately high (3 wells)	(+)
Sulfate	Moderate (most wells)	(+)
Dissolved oxygen	Low to moderate	(-)
Ferrous iron	Moderate	(-)
Manganese dioxide	Very high	(--)
Oxidation-reduction potential	Low to moderate	(-)
pH	7.2 to 8.5	(+)

Notes:

- (+) Increases mobility
- (-) Decreases mobility
- (--) Greatly decreases mobility
- (0) No effect

Other factors not listed above also influence the mobility of hexavalent chromium in the vicinity of well IR10MW12A. Historical results from the HPS database for soil samples collected in IR-10 show high concentrations of iron (average over 30,000 mg/kg) and manganese (average over 1,000 mg/kg). The elevated concentrations of iron and manganese in the area may be due to chert in the fill material as well as from the serpentinite-derived clay.

The borings drilled in IR-10 during the SVE confirmation study (Tetra Tech 2003b), which was performed concurrently with the field work for this investigation, had high levels (about 5 percent) of total organic carbon. This confirms that organic matter for the reduction of hexavalent chromium is available in the subsurface soil in the area.

In summary, the conditions encountered in the vicinity of well IR10MW12A indicate that hexavalent chromium will not migrate toward the Bay.

H6.4 EVALUATION OF CONCENTRATION TRENDS

The concentration trends of hexavalent chromium in well IR10MW12A have varied since this well was first sampled. The high concentrations of hexavalent chromium detected in 1994 (see Figure H-3) may indicate that site conditions changed at that time, causing a release of hexavalent chromium from the underground source into groundwater. The cause of the 1994 release cannot be specified, and may have been due to changing physical or chemical conditions. For example, a new groundwater pathway may have been created that year due to a high groundwater elevation or a pipe that finally rusted through.

After the high concentrations detected in 1994, well IR10MW12A was not sampled for hexavalent chromium again until 2001, when it was incorporated into the RAMP program. Since 2001, it has been sampled for hexavalent chromium six times, exhibiting a generally decreasing trend; the most recent result (November 2002) was nondetected (at a reporting limit of 10 µg/L). During 2003 (Year 4 of the RAMP program), the well will continue to be sampled for hexavalent chromium quarterly.

H7.0 CONCLUSIONS AND RECOMMENDATIONS

The absence of detected results for chromium in the 10 temporary wells located up-, down-, and crossgradient of monitoring well IR10MW12A indicates that hexavalent chromium in groundwater is localized around IR10MW12A, and does not presently pose a threat to the Bay. Hexavalent chromium does not appear to have migrated toward the Bay, either downgradient through the Artificial Fill of the A-aquifer, crossgradient to the storm drain to the west of well IR10MW12A, or through the shallower gravel beds and pipes of the nearby utility lines. In addition, hexavalent chromium concentrations detected in well IR10MW12A have been decreasing during the past year, from 380 µg/L (March 2002) to nondetected at a reporting limit of 10 µg/L (November 2002).

Since chromium was not detected in the temporary wells located near the potential sources inside Building 123, the probable source of hexavalent chromium may be a spill or spills from the wooden loading dock and ramp outside the building. Gravel, silt, and sand to 20.5 feet bgs noted in well IR10MW12A was probably emplaced during construction of the building and installation of its associated utility lines, and may be acting as a repository for hexavalent chromium. The lithology of the temporary well boring logs shows that soil in the investigation area mostly consists of clay materials (see Appendix H1). Clay may be acting as a physical and chemical barrier to the migration of hexavalent chromium from the area immediately surrounding well IR10MW12A.

The Navy recommends that monitoring well IR10MW12A continue to be monitored quarterly for hexavalent chromium in 2003, during Year 4 of the RAMP program. Because hexavalent chromium does not appear to pose a threat to ecological receptors in the Bay and concentrations have decreased during 2002 to nondetected, no other further actions are recommended.

H8.0 REFERENCES

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APPENDIX H1
TEMPORARY AND HISTORICAL MONITORING WELL BORING LOGS



Tetra Tech EM Inc.

Log of Boring: IR10BHG01

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EMI
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.36

Drilling Method: GEOPROBE
Boring Started: 09/12/02
Completed: 09/12/02
Boring Depth (feet bgs): 15.00
Boring Diameter (inches): 0.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		36		IR10BHG001					Ground Surface
1							SM	SM	Concrete
2							CL	CL	
3							ML	ML	SILTY SAND; light brown (5YR 5/6)
4		48					CL	CL	SILTY CLAY with rock fragments
5									CLAYEY SILT; olive gray (5Y 4/2), stiff
6									CLAYEY SILT; pale olive (10Y 6/2)
7									
8		41							CLAY; olive gray (5Y 3/2); non-plastic
9									SILTY CLAY; yellowish gray (5Y 7/2)
10									CLAY; olive gray (5Y 3/2); moist to wet
11									
12									
13									
14									
15									Total depth of boring = 15 feet
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									

Date



Tetra Tech EM Inc.

Log of Boring: IR10BHG02

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.40

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 15.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		38		IR10BHG010					Ground Surface
1								CL	Concrete
2				IR10GB045					SILTY CLAY: olive gray (5Y 3/2), moderate brown mixture
3								ML	
4		48						CL	CLAYEY SILT; olive gray, stiff
5									SILTY CLAY: pale olive, low plasticity
6									
7									
8		48							
9									
10				IR10GB046					
11									
12		0							
13									No recovery 12' to 15'
14									
15									Total depth of boring = 15 feet
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
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31									
32									
33									
34									
35									



Tetra Tech EM Inc.

Log of Boring: IR10BHG03

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.19

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 15.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		24		IR10BHG009					Ground Surface
1								SM	Concrete
2								ML	SILTY SAND; light brown (5YR 5/6)
3								CL	CLAYEY SILT; olive gray (5Y 4/1), stiff
4	48							CL	CLAYEY SILT; pale olive with fine gravel
5								ML	CLAYEY SILT; olive gray
6								ML	SILTY CLAY; pale olive
7								ML	Color change to olive gray and light brown
8	48							ML	CLAYEY SILT; non-plastic
9								CL	CLAY; olive green; low plasticity
10								CL	
11								CL	
12	36							CL	
13								CL	
14								CL	
15								CL	Total depth of boring = 15 feet
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
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30									
31									
32									
33									
34									
35									

Date



Tetra Tech EM Inc.

Log of Boring: IR10BHG04

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 9.61

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 0.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		48		IR10BHG002				CL	Ground Surface
1								CL	Asphalt at surface; CLAY; moderate reddish brown (10R 4/6)
2								CL	Color change to dark yellowish brown (10YR 4/2)
3								CL	
4		24						CL	SILTY CLAY
5								CL	SILTY CLAY; pale green (10G 6/2)
6								GM	
7								GM	GRAVELLY SILT
8		29						CL	Becomes wet
9								CL	
10								CL	CLAY; dark greenish gray (5GY 4/1), low plasticity
11								CL	
12								CL	Total depth of boring = 12 feet
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									



Tetra Tech EM Inc.

Log of Boring: IR10BHG05

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 9.60

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.00

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		29						GP	Ground Surface
1								CL	Asphalt at surface; GRAVEL; pale gray
2									SILTY CLAY; moderate reddish brown (10R 4/6)
3								OH	
4		48						GP	CLAY; moderate brown (5Y 4/4)
5								ML	SAND; moderate olive brown
6									SAME AS ABOVE
7									
8		48						OH	CLAYEY SILT; grayish green (10GY 5/2)
9									SAME AS ABOVE
10									
11									CLAY; dark greenish gray (5GY 4/1)
12									Total depth of boring = 12 feet
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									

Date



Tetra Tech EM Inc.

Log of Boring: IR10BHG06

Logged By: J. MEDLEY

Logging Consultant: TECTRA TECH EM

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 10.04

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0	43		IR10BHG004				ML	Ground Surface
1							CL	Asphalt at surface; SILT; moderate yellowish brown with rock fragments
2								SILTY CLAY; light olive gray (5Y 5/2)
3								
4	43							
5								
6								
7								
8	34							
9								
10								
11								
12								Total depth of boring = 12 feet
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Tetra Tech EM Inc.

Log of Boring: IR10BHG07

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EM
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 10.10

Drilling Method: GEOPROBE
Boring Started: 09/13/02
Completed: 09/13/02
Boring Depth (feet bgs): 11.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		46		IR10BHG005				CL	Ground Surface
1								ML	Asphalt at surface; SILTY CLAY; olive black (5Y 2/1)
2								CL	SILT; low plasticity
3									
4	24								SILTY CLAY; moderate olive brown (5Y 4/4) to light olive (10Y 5/4)
5									GRAVELLY SILTY CLAY; dark yellowish brown (10YR 4/2)
6									
7									GRAVELLY SILT CLAY; wet
8	24								
9									
10									No recovery 9'-11'
11									Total depth of boring = 11 feet
12									
13									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10BHG08

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EM

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 10.03

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 11.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		48		IR10BHG006				ML	Ground Surface
1								ML	Asphalt at surface; SILT; dark greenish gray
2								ML	CLAYEY SILT; moderate olive brown (5Y 4/4)
3								CL	
4		48						CL	SITLY CLAY; olive gray (5Y 3/2)
5								CL	Color change to dark yellowish brown (10YR 4/2)
6								CL	CLAY; dark greenish gray (5G 4/1), wet
7								CL	
8		30						CL	
9								CL	
10								CL	
11								CL	Total depth of boring = 11 feet
12									
13									
14									
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21									
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Tetra Tech EM Inc.

Log of Boring: IR10BHG09

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 10.41

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		36		IR10BHG007				GP	Ground Surface
1									Asphalt at surface; SAND with GRAVEL; fine to coarse
2								CL	
3								ML	CLAY; pale olive (6/2)
4		48						CL	CLAYEY SILT
5									SILTY CLAY; light brown
6									
7									
8		0							Color change to olive gray (5Y 5/2)
9									No recovery 8'-12'
10									
11									
12									Total depth of boring = 12 feet
13									
14									
15									
16									
17									
18									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10BHG10

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EM

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 10.61

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		29		IR10BHG008				GM	Ground Surface
1								GC	Asphalt at surface, SANDY SILTY GRAVEL; light olive brown (5Y 5/6) with rock fragments
2								GC	CLAYEY GRAVEL with angular rock fragments
3								CL	CLAY; greenish gray (5GY 6/1)
4	48							CL	CLAY; brown (5YR 3/4), wet
5								CL	No recovery 8'-12'
6									
7									
8	0								
9									
10									
11									
12									Total depth of boring = 12 feet
13									
14									
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Tetra Tech EM Inc.

Log of Boring: IR10GB001

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.10

Drilling Method: GEOPROBE

Boring Started: 09/10/02

Completed: 09/10/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		19			3				Ground Surface
1								SP	Concrete
2								CL	
3									SITLY SAND; brown (5YR 4/4)
4		43		IR10GB002	3				SITLY CLAY; fine gravel
5									SILTY CLAY; greyish blue, fine gravel
6				IR10GB001				OL	
7									CLAYEY SILT; bluish gray, coarse gravel
8		48			3				
9									SILTY CLAY; medium dark gray
10									CLAY; dark grey
11									
12									Total depth of boring = 12 feet
13									
14									
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18									
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Tetra Tech EM Inc.

Log of Boring: IR10GB002

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.16

Drilling Method: GEOPROBE

Boring Started: 09/12/02

Completed: 09/12/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	QVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		24							Ground Surface
1								GP	Concrete
2									GRAVEL with subangular rock fragments
3									
4		36						ML	SILTY SAND; medium light brown
5				IR10GB003				CL	CLAYEY SILT; olive brown
6									
7									
8		38						ML	SILT; light brown with angular fine gravel
9				IR10GB004				CL	CLAYEY SILT; dark greenish gray (5G 4/1)
10									SILTY CLAY; dark greenish gray (5GY 4/1) with fine gravel
11									Total depth of boring = 12 feet
12									
13									
14									
15									
16									
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Tetra Tech EM Inc.

Log of Boring: IR10GB003

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EMI
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.05

Drilling Method: GEOPROBE
Boring Started: 09/12/02
Completed: 09/12/02
Boring Depth (feet bgs): 12.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		36							Ground Surface
1					2.7			CL	Concrete
2					1.1				
3				IR10GB005	20.2				SILTY CLAY; medium brown with fine gravel
4				IR10GB005Z	30				
5		48			51			OL	
6								OH	SILT; with fine gravel
7					0			ML	CLAY; light olive
8				IR10GB006	1.6				
9				IR10GB006Z	2.2				CLAYEY SILT; greenish (10Y 4/2)
10					1.6				
11					9.2				CLAYEY SILT; grayish green (5GY 5/2)
12					1			CL	SILTY CLAY; grayish green (10GY 5/2)
13					0				
14					2.7				
15					0				
16									
17									
18									
19									
20									
21									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB004

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.19

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		34							Ground Surface
1					0			SM	Concrete
2					0			CL	SILTY SAND; moderate yellowish brown (10YR 5/4) with fine gravel
3					1.9				
4		36		IR10GB007	3.1				SILTY CLAY; with fine gravel
5					0				CLAY; grayish brown (5YR 3/2)
6					0				SILTY CLAY; with gravel; dark yellowish brown (10YR 4/2)
7					0				
8		46			0				SILTS; with gravel; 4 inches thin sliced rocks
9				IR10GB008	0				CLAY; medium light gray clay
10					0				CLAY; brownish gray clay (5YR 4/1)
11					0			CH	
12					0				SILTY CLAY; medium gray
13									CLAYEY SILT; dark greenish gray (5GY 4/1)
14									CLAY; brownish gray (5YR 4/1)
15									Total depth of boring = 12 feet
16									
17									
18									
19									
20									
21									
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Tetra Tech EM Inc.

Log of Boring: IR10GB005

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EMI
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.10

Drilling Method: GEOPROBE
Boring Started: 09/12/02
Completed: 09/12/02
Boring Depth (feet bgs): 12.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		24							Ground Surface
1								ML	Concrete
2					0				
3				IR10GB010	1.2			GM	SILT AND CLAYEY SILT; moderate brown with fine gravel
4				IR10GB010Z	2.5				
5					2.5				SILTY GRAVEL
6					0			CL	
7					0				SILTY CLAY; light olive gray
8					0				SILTY CLAY; light brown
9					1.2			ML	SILTY CLAY; pale olive gray
10				IR10GB009	1.2				
11					9				CLAYEY SILT; pale olive
12					10.3				SAME AS ABOVE
13					1.2				SILTY CLAY
14									CLAY
15									Total depth of boring = 12 feet
16									
17									
18									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB006

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.19

Drilling Method: GEOPROBE

Boring Started: 09/13/02

Completed: 09/13/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		8			0				Ground Surface
1								SM	Concrete
2									SILTY SAND
3								CL	SILTY CLAY; light brown (5YR 5/6)
4									
5					1.5				
6				IR10GB011	2.7			ML	Color change to grayish olive (10Y 4/2)
7					1.5				
8									SILT; grayish olive
9					9.5				
10				IR10GB012	31.3				
11					12.1				
12					10.8			CL	CLAY; olive gray (5YR 3/2)
13					7				Total depth of boring = 12 feet
14					4.4				
15									
16									
17									
18									
19									
20									
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Tetra Tech EM Inc.

Log of Boring: IR10GB007

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EM
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.12

Drilling Method: GEOPROBE
Boring Started: 09/12/02
Completed: 09/12/02
Boring Depth (feet bgs): 12.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		29			0				Ground Surface
1								ML	Concrete
2									GRAVELLY SILT, medium brown, moist
3									SILT; grayish olive with gravel
4		48			0				
5					1.6				
6					.5				
7					.5				Color change to light olive
8		48			.5				
9					5.9			CL/ML	CLAYEY SILT; light olive with gravel
10				IR10GB013	20.6				
11					10				SAME AS ABOVE
12				IR10GB014	1.6				
13					1.6				SILTY CLAY; dusky olive green (5G 3/2)
14									SAME AS ABOVE; with more SILT
15									CLAYEY SILT
16									Total depth of boring = 12 feet
17									
18									
19									
20									
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Tetra Tech EM Inc.

Log of Boring: IR10GB008

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.31

Drilling Method: GEOPROBE

Boring Started: 09/12/02

Completed: 09/12/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		32							Ground Surface
1								CL	Concrete
2					2.7				SILTY CLAY; brown (5YR 3/4), with gravel, moist
3					1.6				
4					5.9				
5		48			7				SAME AS ABOVE; subangler ROCK FRAGMENTS 0.25" TO 0.5"
6				IR10GB015	4.8			ML	CLAYEY SILT; light brown with fine gravel
7					1.6				
8					23.5				
9					21.2			CL	CLAYEY SILT; greenish gray
10				IR10GB016	2.7				SILTY CLAY; with fine gravel
11					1.6				SAME AS ABOVE; greenish gray
12								ML	CLAYEY SILT; with some fine gravel
13									Total depth of boring = 12 feet
14									
15									
16									
17									
18									
19									
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21									
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Tetra Tech EM Inc.

Log of Boring: IR10GB009

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EM
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.14

Drilling Method: GEOPROBE
Boring Started: 09/12/02
Completed: 09/12/02
Boring Depth (feet bgs): 12.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		24							Ground Surface
1								ML	Concrete
2					13.5				CLAYEY SILT; medium brown with gravel
3				IR10GB017					
4				IR10GB017Z					
5		48						CL	SILTY CLAY; greenish gray (5GY 6/1)
6									
7									
8		48			.2				
9					1.6			ML	
10				IR10GB018Z	2.7				CLAYEY SILT; medium brown
11				IR10GB018				CL	
12									CLAY; dark greenish gray
13									Total depth of boring = 12 feet
14									
15									
16									
17									
18									
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21									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB010

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.11

Drilling Method: GEOPROBE

Boring Started: 09/10/02

Completed: 09/10/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		31			0			SP	Ground Surface
1									Asphalt as surface; GRAVELLY SAND; brown
2					3			CL	
3									SILTY CLAY; brown (5YR 3/4) with gravel
4					5				SILTY CLAY; grayish olive (10Y 4/2), low to mid plasticity
5					3				
6					6				
7				IR10GB020	9				
8					6				SILTY CLAY, light olive brown, angular rock fragments 3 to 4 inches
9					8				CLAY; dark olive gray (5Y 3/2)
10				IR10GB019					
11					7				CLAYEY SILT; black gray
12									SILTY CLAY; light olive brown with fine gravel (0.25")
13									Total depth of boring = 12 feet
14									
15									
16									
17									
18									
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Tetra Tech EM Inc.

Log of Boring: IR10GB011

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.13

Drilling Method: GEOPROBE

Boring Started: 09/11/02

Completed: 09/11/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		24							Ground Surface
1					0			GW	Concrete
2					.4			SM	SAND; light brown
3					.6			GP	SAND; reddish brown
4		48			0			ML	SAND; reddish brown
5					0				SILTY SAND
6					1				SAND
7					1				
8					.4				CLAYEY SILTS; light olive (10YR 5/4) to greyish olive 10 YR 4/2
9				IR10GB021	39				CLAYEY SILT; angular rocks 1/2" in size
10					8				CLAYEY SILT; light olive silt, grayish olive (5GY 3/2)
11									CLAYEY SILT; lighter coloring
12				IR10GB022	9				CLAYEY SILT; very pale green (10 Y 8/2)
13									Total depth of boring = 12 feet
14									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB012

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EM

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.27

Drilling Method: GEOPROBE

Boring Started: 09/10/02

Completed: 09/10/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0					48			SP	Ground Surface
1					1.5			CL	Concrete at surface; SAND; olive brown (5Y 4/4)
2					2.5				SILTY CLAY: light olive brown (5Y 5/6), low plasticity
3					2				SILTY CLAY: Medium gray brown
4		48			1.5				
5					3				
6				IR10GB023	3.5				
7					2.5				
8		48			1.9				SILTY CLAY with subangular rock fragments, stiff
9					2.5				CLAY; Light grey, very hard
10									
11				IR10GB024	3.6				SILTY CLAY; Gray with angular gravel
12									Total depth of boring = 12 feet
13									
14									
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21									
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Tetra Tech EM Inc.

Log of Boring: IR10GB013

Logged By: J. MEDLEY
Logging Consultant: PRECISION
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.06

Drilling Method: GEOPROBE
Boring Started: 09/10/02
Completed: 09/10/02
Boring Depth (feet bgs): 12.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		3							Ground Surface
1								SP	Concrete
2									SAND; olive gray, with gravel
3									
4		48						SC	SILTY CLAY; dark gray, with gravel
5									
6				IR10GB026					
7									
8		38						CL	SILTY CLAY; brownish with blue/green staining
9									
10				IR10GB025				SM	SILTY SAND; greenish blue
11								CL	CLAY; bluish gray with subangular gravel/rocks 1" TO 2"
12									Total depth of boring = 12 feet
13									
14									
15									
16									
17									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB014

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.47

Drilling Method: GEOPROBE

Boring Started: 09/10/02

Completed: 09/10/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0	38			1.4				Ground Surface
1							GL	Concrete
2							CL	GRAVELLY CLAY; moderate brown
3								
4	48		IR10GB027	10.4			OL	SILTY CLAY; dark brown to moderate brown, with fine gravel
5								CLAY; dark brown, stiff
6								
7							CL	CLAYEY SILT; fine gravel, stiff
8	48			9.8				SILTY CLAY; dusky yellow to light grey, low plasticity
9			IR10GB028				OL	SILT; grey, fine gravel
10								CLAYEY SILT; olive brown, fine gravel
11								
12								CLAY; olive brown
13								Total depth of boring = 12 feet
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Tetra Tech EM Inc.

Log of Boring: IR10GB018

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EMI
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.12

Drilling Method: GEOPROBE
Boring Started: 09/10/02
Completed: 09/10/02
Boring Depth (feet bgs): 12.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		31							Ground Surface
1								SP	Concrete
2								CL	SAND; Brown (5YR 3/4)
3									SILTY CLAY; Reddish brown with greenish blue staining, coarse angular gravel
4									SILTY CLAY; with coarse gravel
5									CLAY; gray, with coarse gravel
6				IR10GB035				ML	
7								CL	SILTY CLAY; gray, with subangular gravel
8									SAME AS ABOVE; with 4 inches of subangular gravel
9									SILTY CLAY; bluish gray
10				IR10GB036					
11									SILTY CLAY; Dark gray, with coarse gravel
12									CLAY; Dark gray (N4) and dark brown
13									Total depth of boring = 12 feet
14									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB016

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.09

Drilling Method: GEOPROBE

Boring Started: 09/10/02

Completed: 09/10/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		24			3				Ground Surface
1								SC	Concrete
2									Clayey sand, brown with angular gravel and rock fragments 1"
3				IR10GB031				CL	Clay, (5YR 4/1) dark grayish brown with subangular rock fragments
4		46			0				Silty clay, (5 Y 4/4) brown with angular rock fragments 0.25" to 0.5"
5								SM	SANDY SILT; grayish olive (10Y 4/2)
6								CL	SILTY CLAY; stiff, light medium grey (N6) with angular coarse gravel and silt
7									Color change to brownish gray (5YR 4/1)
8		48		IR10GB032				SM	SILTY SAND; (SG 4/1) with fine gravel
9									Total depth of boring = 12 feet
10									
11									
12									
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Tetra Tech EM Inc.

Log of Boring: IR10GB017

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.06

Drilling Method: GEOPROBE

Boring Started: 09/11/02

Completed: 09/11/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		36			0				Ground Surface
1								CL	Concrete
2								ML	SILTY CLAY; gray with sandy silt and subangular rock fragments 0.5" in size
3								ML	Color change to moderate yellowish brown (10YR 5/4)
4		48			.6				CLAYEY SILT; hard
5				IR10GB033	1.2				
6								CL	SILT; light brown with subangular fine gravel
7								CL	
8								ML	SILTY CLAY; hard, brown (10YR 2/2)
9								ML	Color change to pale olive (10Y 6/2)
10								ML	
11								ML	SILT; dusky yellow
12				IR10GB034					SILTY CLAY; pale olive to grayish olive, with angular gravels
13									CLAYEY SILT; grayish olive with rock fragments 6" in size
14									Total depth of boring = 12 feet
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Date

Page 1 of 1



Tetra Tech EM Inc.

Log of Boring: IR10GB018

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.12

Drilling Method: GEOPROBE

Boring Started: 09/10/02

Completed: 09/10/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		31							Ground Surface
1								SP	Concrete
2								CL	SAND; Brown (5YR 3/4)
3									SILTY CLAY; Reddish brown with greenish blue staining, coarse angular gravel
4									SILTY CLAY; with coarse gravel
5									CLAY; gray, with coarse gravel
6				IR10GB035					SILTY CLAY; gray, with subangular gravel
7								ML	
8								CL	
9									SAME AS ABOVE; with 4 inches of subangular gravel
10				IR10GB036					SILTY CLAY; bluish gray
11									SILTY CLAY; Dark gray, with coarse gravel
12									CLAY; Dark gray (N4) and dark brown
13									Total depth of boring = 12 feet
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Tetra Tech EM Inc.

Log of Boring: IR10GB019

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.18

Drilling Method: GEOPROBE

Boring Started: 09/11/02

Completed: 09/11/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		36							Ground Surface
1							HHHH	SM	Concrete
2					1			CL	
3					1.5				SILTY SAND; moderate brown (5YR 3/4) with gravel
4				IR10GB037	1.7				
5								SM	SILTY CLAY; greyish olive with gravel
6					1				SILTY SAND; with coarse gravel
7								ML	
8					1.7			SM	SILT; grayish olive (10Y 4/2) with subangular gravel
9		34							SILTY SAND; pale olive
10					0			ML	
11				IR10GB038	1			CL	CLAYEY SILT
12					1.2				CLAY
13					.8				Total depth of boring = 12 feet
14									
15									
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19									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB020

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.15

Drilling Method: GEOPROBE

Boring Started: 09/12/02

Completed: 09/12/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		29							Ground Surface
1							HHHHH	GM	Concrete
2								CL	GRAVEL; gray
3									
4		48							SILTY CLAY; light brown (5YR 5/6) with 30% gravel
5									SAME AS ABOVE; 10% gravel
6					1.2				
7					1.2			ML	SILT; pale olive (10Y 6/2) with rock fragments of 4" in size
8				IR10GB039	2.5				CLAYEY SILT; light olive (10Y 5/4)
9		48							CLAYEY SILT; pale yellowish brown (10YR 6/2)
10				IR10GB040					SAME AS ABOVE
11									
12									SILTY CLAY; dark yellowish brown (10YR 4/2)
13									Total depth of boring = 12 feet
14									
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Tetra Tech EM Inc.

Log of Boring: IR10GB021

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.07

Drilling Method: GEOPROBE

Boring Started: 09/11/02

Completed: 09/11/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		31			0				Ground Surface
1								ML	Concrete
2					.4				
3					3.4			GC CL	SILT WITH GRAVEL; brown
4		48		IR10GB041	1.1			SM	GRAVEL; with gray rock fragments and clay
5					1.4				
6					1.9			ML	SILTY CLAY; brown (10YR 4/2)
7					2.4			GM	SANDY SILT; moderate brown
8					1.1			CL	CLAYEY SILT; light olive brown (5Y 5/6)
9					.5				
10					2				SILTY GRAVEL
11				IR10GB042	.8				CLAY; Stiff
12									CLAY; brown change to SILTY CLAY, light olive (10Y 5/4)
13									SITLY CLAY; medium bluish gray (5B 5/1)
14									SILTY CLAY; greenish gray (5G 6/1), wet
15									Total depth of boring = 12 feet
16									
17									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10GB022

Logged By: J. MEDLEY

Logging Consultant: TETRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.36

Drilling Method: GEOPROBE

Boring Started: 09/12/02

Completed: 09/12/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		31							Ground Surface
1								GM	Concrete
2								CL	GRAVEL
3								ML	SILTY CLAY; moderate light brown with fine gravel
4		46		IR10GB044	1.2				CLAYEY SILT; light olive gray (5Y 5/2)
5					1.2				
6								CL	CLAYEY SILT; dark yellowish brown
7									
8					1.2				CLAYEY SILT; light brown
9					2.5				
10				IR10GB043	1.2				SILTY CLAY; light olive with subangular rock fragments
11					1.2				CLAY TO SILTY CLAY WITH GRAVEL; grayish brown
12									Total depth of boring = 12 feet
13									
14									
15									
16									
17									
18									
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Tetra Tech EM Inc.

Log of Boring: IR10SG040

Logged By: J. MEDLEY
Logging Consultant: TETRA TECH EMI
Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY
Project No: DO 047
Location: IR10
Ground Surface Elevation (feet MSL): 14.25

Drilling Method: GEOPROBE
Boring Started: 09/10/02
Completed: 09/10/02
Boring Depth (feet bgs): 12.00
Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		38							Ground Surface
1					0			CL	Concrete
2				0037J046	5				SILTY CLAY; reddish brown with fine angular gravel
3					32				Color change to brown (5YR 4/4)
4		40		0037J047				ML	Color change to grayish brown (5YR 3/2)
5					0				CLAYEY SILT; olive gray (5Y 3/2)
6				0037J048	0				
7					0			CL	CLAY; olive gray (5Y 3/2)
8		48		0037J049	0				SILTY CLAY; brownish olive gray (5Y 3/2), with small subangular gravel
9					0				CLAY; olive gray w/black staining
10				0037J050	0				Total depth of boring = 12 feet
11									
12									
13									
14									
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16									
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Date



Tetra Tech EM Inc.

Log of Boring: IR10SG041

Logged By: J. MEDLEY

Logging Consultant: TECTRA TECH EMI

Drilling Company: PRECISION

Project: SVE CONFIRMATION/CR6 STUDY

Project No: DO 047

Location: IR10

Ground Surface Elevation (feet MSL): 14.26

Drilling Method: GEOPROBE

Boring Started: 09/10/02

Completed: 09/10/02

Boring Depth (feet bgs): 12.00

Boring Diameter (inches): 1.75

DEPTH (FEET)	DRIVE INTERVAL	RECOVERY (IN)	BLOW COUNTS	SAMPLE ID	OVM (PPM)	WATER LEVEL	GRAPHIC LOG	USCS SOIL TYPE	DESCRIPTION
0		41			22				Ground Surface
1								ML CL	Concrete
2				0037J056					CLAYEY SILT; reddish brown, fine gravel
3					15.6				
4		48		0037J057	3.5				SILT; light grey, gravel, fine, subangular
5									SILTY CLAY; olive gray
6				0037J058	21.1				SILT; olive grey, fine gravel
7									
8		48		0037J059	1.5				SILTY CLAY; light olive grey (5Y 5/2)
9									SILT; grey, fine gravel
10				0037J060					
11								OL	CLAYEY SILT; light olive grey (5Y 5/2)
12									Total depth of boring = 12 feet
13									
14									
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APPENDIX I
TRIGGER LEVELS FOR GROUNDWATER IMPACT TO SAN FRANCISCO BAY

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ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
AF	Attenuation factor
AWQC	Ambient water quality criteria
Basin Plan	Water Quality Control Plan for the San Francisco Bay Basin
BHC	Benzene hexachloride, also known as hexachlorocyclohexane
CCC	Criterion Continuous Concentration
CMC	Criterion Maximum Concentration
COC	Chemical of concern
COPEC	Chemical of potential ecological concern
CPRD	Coastal Protection and Restoration Division
CTR	California Toxics Rule
EI	Environmental indicator
EPA	U.S. Environmental Protection Agency
FAV	Final acute values
FCV	Final chronic values
FPV	Final plant values
FRV	Final residue values
FS	Feasibility Study
HGAL	Hunters Point groundwater ambient level
HPS	Hunters Point Shipyard
IR	Installation Restoration
NAWQC	National Ambient Water Quality Criteria
NOAA	National Oceanic and Atmospheric Administration
NRWQC	National Recommended Water Quality Criteria
PVC	Polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
TMSRA	Technical Memorandum in Support of a Record of Decision Amendment
Water Board	San Francisco Bay Regional Water Quality Control Board

11.0 INTRODUCTION

This appendix summarizes the development of trigger levels for groundwater at Parcel B. Trigger levels were developed because chemicals in groundwater at Hunters Point Shipyard (HPS) have the potential to affect surface waters if they migrate and discharge to San Francisco Bay (Bay) at sufficiently high concentrations. This appendix is an integral part of the technical memorandum in support of a record of decision amendment (TMSRA) and is not intended to stand alone. Please refer to the main text of the TMSRA for supporting information that is not repeated in this appendix.

Chemicals in groundwater at HPS have the potential to affect surface waters if they migrate and discharge to San Francisco Bay. Surface water quality goals, such as the National Ambient Water Quality Criteria (NAWQC) and the California Toxics Rule (CTR), have been developed to protect the environment, including marine organisms, from effects caused by chemicals in surface water. The beneficial uses of groundwater do not include maintenance of freshwater or marine organisms because these organisms do not live in groundwater. No water quality criteria for the protection of organisms exist for groundwater; therefore, alternative water quality criteria for groundwater must be developed to evaluate the potential for chemicals in groundwater to result in effects to the bay.

Various processes occur in the subsurface that reduce chemical concentrations in groundwater as the groundwater migrates toward a discharge point such as the bay. These processes include hydrodynamic dispersion, sorption, chemical and biological transformation, dilution in the tidal mixing zone, and dilution on discharge to a surface water body. Therefore, it is not appropriate to apply surface water quality criteria directly to groundwater; rather, surface water quality criteria apply only to surface waters. The purposes of this appendix are as follows:

1. Discuss the applicable toxicological and physicochemical factors relevant to developing trigger levels for Parcel B groundwater that would meet surface water quality criteria at the discharge point to the bay.
2. Review a variety of lines of evidence that indicate the magnitude of the expected reduction in chemical concentrations when groundwater discharges to the bay.
3. Based on items 1 and 2, develop trigger levels at various inland locations for groundwater that will ensure surface water quality criteria are not exceeded if groundwater at Parcel B discharges to the bay.

The trigger levels described in this appendix are intended to serve as comparison values for groundwater to identify when additional evaluation may be necessary. The additional evaluations that may occur following an exceedance include:

- Increasing the frequency of monitoring in the well where the trigger level was exceeded to evaluate whether the exceedance is persistent;
- Monitoring groundwater at a location farther downgradient to evaluate whether the attenuation estimated in establishing the trigger level has occurred;
- Using site-specific detailed information to more accurately estimate attenuation (including processes such as adsorption and degradation); or
- Implementing a selected remediation alternative for groundwater treatment.

There are no surface water bodies on Parcel B; however, the Navy evaluated federal and state surface water quality criteria as potential applicable or relevant and appropriate requirements (ARAR) for Parcel B because groundwater discharges to the bay. For the A- and B-aquifers, the Navy has determined that the state standards promulgated in Table 3-3 of the Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) and the federal standards promulgated in the CTR are potential ARARs for Parcel B to be met at the interface of A- and B-aquifer groundwater and the bay. Conversely, the Navy has determined that the guidelines in the National Recommended Water Quality Criteria (NRWQC) (EPA 2006a) and NAWQC are not ARARs for the interface of the A- and B-aquifer groundwater and the bay because there are other standards better suited to Parcel B (Table 3-3 and CTR). (Refer to Section C2.2.2 in Appendix C for more complete discussion of ARARs for surface water.) All of these standards apply to surface water; none of them apply to groundwater. Therefore, these potential surface water ARARs would be applied to the surface water at the interface of A- and B-aquifer groundwater and would not be used to set cleanup standards for *in situ* A- or B-aquifer groundwater at Parcel B.

The evaluations in this appendix consider both ARAR-based surface water quality criteria (Table 3-3 and CTR) and non-ARAR-based criteria (NRWQC and NAWQC) in selecting trigger levels for groundwater at Parcel B to provide a comprehensive analysis as agreed to with the regulatory agencies. However, only those trigger levels that are based on ARARs (Table 3-3 and CTR) will be carried forward in the TMSRA. Only those trigger levels based on ARARs will be considered in the remedial design during the preparation of the groundwater monitoring plan.

Section 12.0 of this appendix identifies the surface water quality criteria that are protective of marine organisms in the bay under long-term (chronic) exposure scenarios. Section 13.0 compares groundwater concentrations at Parcel B with surface water quality criteria, highlighting chemicals in groundwater that at maximum concentrations exceeded the water quality criteria for the bay, and identifies groundwater chemicals of concern. Section 14.0 reviews the lines of evidence that indicate the magnitude of the reduction in chemical concentrations that can be expected as groundwater migrates toward and when groundwater discharges to a surface water body. Section 15.0 proposes trigger levels for groundwater based on the lines of evidence presented in Section 14.0 for each of the areas at Parcel B where groundwater concentrations exceed surface water quality criteria. Section 16.0 reviews the uncertainty related to establishing trigger levels for groundwater that will meet the promulgated surface water quality criteria for

the bay. Section 17.0 provides a summary and conclusions for development of trigger levels for groundwater for Parcel B. References for this appendix are provided in Section 18.0.

12.0 SELECTION OF SURFACE WATER QUALITY CRITERIA TO BE APPLIED TO GROUNDWATER

Surface water quality criteria are not applicable to groundwater; however, potential impacts to the bay could occur if concentrations of chemicals in groundwater that exceed surface water quality criteria were to discharge to surface waters. This highly conservative screening method minimizes the potential that discharge of groundwater from Parcel B would affect the water quality of the bay.

As directed by Section 304(a) of the Clean Water Act, the U.S. Environmental Protection Agency (EPA) develops and publishes national recommended criteria as guidance to states and tribes for the promulgation of surface water quality standards. The law requires that these criteria be based on the latest scientific knowledge. State and regional regulatory agencies responsible for monitoring and maintaining beneficial use of the waters of the state often adopt national criteria with modifications that reflect regional conditions, including naturally occurring (ambient) concentrations of metals.

Surface water quality criteria that apply at HPS were compiled through a review of published regulatory standards, goals, and guidance, including those established by the San Francisco Bay Regional Water Quality Control Board (Water Board) in "Water Quality Control Plan, San Francisco Bay Basin Region" (Water Board 2006a) and "A Compilation of Water Quality Goals" (Marshack 2007); EPA in the California Toxics Rule (EPA 2000) and National Recommended Water Quality Criteria (EPA 2006a); and other sources, as appropriate (Water Board 1998). Table I-1 presents this compilation of surface water quality criteria that are applicable to the bay. As noted in Section 11.0, criteria from the Basin Plan and the CTR are ARARs while the other criteria are not.

The selection of surface water quality criteria to be used for a preliminary screening of the groundwater data is described in Section 12.1. The U.S. Department of the Navy derived a surface water quality criterion for chromium III for this project because the only available criterion for chromium was based on chromium VI. The methods and rationale for derivation of the chromium III value are presented in Section 12.2. Like the NAWQC and NRWQC, the criterion for chromium III is not an ARAR. Results for groundwater samples at Parcel B were also compared with Hunters Point groundwater ambient levels (HGAL) to distinguish site-related chemicals from background concentrations (PRC Environmental Management, Inc. 1996), as discussed in Section 12.3.

Two levels of protectiveness — differentiated by estimates of exposure duration — are addressed by water quality criteria. Acute exposure is generally defined as less than 96 hours, while chronic exposure is a period longer than acute exposure and includes durations up to the organism's entire lifetime. In general, the acute exposure criteria are much higher than the chronic exposure criteria because of the much shorter exposure duration under the acute scenario. The water quality criteria are not simply numerical targets, however; instead, the criteria specify a magnitude, duration, and frequency to be met to protect marine organisms. For example, chronic criteria are applied as a limit on the 4-day average concentration in the environment. Both the acute and chronic criteria are values that are not to be exceeded more than once in 3 years.

The connection between groundwater at Parcel B and the bay is assumed to be complete. However, selection of appropriate water quality criteria (acute or chronic) for a site requires that the exposure scenario be defined. Normally, short-term exposure to a groundwater discharge before it is diluted in the receiving waters would be considered an acute exposure. The longer-term exposures that occur within the receiving water are considered chronic exposures. For this evaluation, the chronic (long-term) water quality criteria were used as screening values to provide a conservative approach. Although the Navy and the regulatory agencies debated the merits and drawbacks of adopting a conservative approach, the agencies' opinion was that a very high level of conservatism was required, and the Navy agreed to pursue this evaluation using several highly conservative assumptions.

Available water quality criteria are shown in Table I-1. No chronic laboratory tests have been conducted for some chemicals, so the acute test results were adjusted to estimate a chronic value (by applying lowering the value by 80 percent [EPA 1986]). Acute exposure is represented by the Criterion Maximum Concentration (CMC), which is an estimate of the highest concentration of a chemical in surface water that can be briefly exposed to an aquatic community (generally from 48 to 96 hours) without resulting in an unacceptable effect (<http://www.epa.gov/waterscience/criteria/wqcriteria.html>).

Chronic exposure is represented by the Criterion Continuous Concentration (CCC), which is an estimate of the highest concentration of a chemical in surface water that can be exposed indefinitely to an aquatic community without resulting in an unacceptable effect (<http://www.epa.gov/waterscience/criteria/wqcriteria.html>).

As a practical matter, marine organisms in the bay will be exposed to groundwater only briefly, at the precise point of its entry to the bay. Even at the point of entry into the bay, some dilution of groundwater will already have occurred within the tidal mixing zone that extends landward from the sediment/water interface. The acute exposure scenario best represents the actual exposure of organisms to chemicals in the groundwater plume at the sediment-water interface because of the short time before groundwater mixes with the surrounding surface water. Once the expected mixing of discharged groundwater with receiving waters occurs, a chronic exposure scenario is more representative of conditions experienced by marine organisms.

The Water Board (2006b) has requested that the Navy focus on the point where groundwater enters the bay rather than on the post-mixing conditions that prevail more generally; elimination of mixing within the bay adds a significant conservative element to the evaluation. Therefore, the acute exposure scenario, represented by the CMCs, is the most relevant and appropriate set of water quality criteria for this evaluation. However, the chronic surface water quality criteria (CCC) were used for this evaluation to maintain consistency with agreements between the Navy and the Water Board to provide a highly conservative approach. Use of chronic instead of acute criteria adds a further degree of conservatism to the assessment. Uncertainties associated with use of the chronic criteria in an acute exposure scenario are discussed in Section I6.0.

A set of surface water quality criteria was selected for use in the screening-level evaluation from available regional, state, and federal surface water quality criteria, as shown in Table I-1. Individual toxicity criteria were selected using a methodology that first sorts and selects criteria by applicability and quality of data into one of four tiers. Chronic exposure toxicity criteria were identified as most applicable for the exposure scenario at Parcel B and more protective (lower concentration values) than short-duration acute or instantaneous exposure toxicity criteria (higher concentration values). As a result, applicable chronic exposure toxicity criteria were assigned to the first tier of applicability. Where more than one applicable toxicity value was available in the same tier, the most protective (lowest) value was selected for screening.

If no first-tier criterion was available for a specific analyte, then an acute value was selected as a second-tier criterion. Each acute criterion was made more protective by applying the standard convention of lowering the value by 80 percent to make acute criteria more appropriate for use in chronic exposure scenarios (EPA 1986). Where no first- or second-tier criteria were available, instantaneous criteria were used as third-tier criteria. Each instantaneous criterion was made more protective by lowering the value by 90 percent to make them more appropriate for use in chronic exposure scenarios (EPA 1986). The last column in Table I-1 indicates the surface water quality criteria that were selected as screening criteria for groundwater.

I2.2 DERIVATION OF CHROMIUM III WATER QUALITY CRITERIA

No marine chronic value for chromium III has been derived by the regulatory agencies responsible for maintaining water quality because chromium III is not considered a major environmental threat. As discussed later in this section, EPA (1980) found that data were not sufficient to justify setting a marine criterion for chromium III. Attention instead has been focused on chromium VI because toxic effects have been well demonstrated. Likewise, chromium III is not considered of great concern during the groundwater assessments at HPS; however, natural or induced degradation of the chromium VI plumes may increase concentrations of chromium III in groundwater as a byproduct of mitigation. The chromium VI criteria are generally the only standards for chromium in marine surface water (EPA 2006a). In the absence of a surface water quality criterion for chromium III for marine waters, states often use the chromium VI value as a default, with an acknowledgement that chromium III is considerably less toxic. In this appendix, chromium VI detections in groundwater will be screened against the chromium VI criterion and total chromium concentrations in groundwater will be screened against a derived chromium III surface water quality criterion.

Although a wide variety of procedures have been used to derive water quality criteria, most of them have been developed using some variation of the theoretical toxicological approach, an effects-based approach that relies on published toxicity data from the scientific literature.

EPA's formal protocol for deriving surface water quality criteria for the protection of marine organisms and their uses requires information on the physical and chemical properties of the substance under consideration, on its toxicity to aquatic plants and animals, on its bioaccumulation in aquatic organisms, and on its potential effects on consumers of aquatic biota (Stephan and others 1985). The formalized protocol includes specific procedures for calculating the final acute values (FAV), final chronic values (FCV), final plant values (FPV), and final residue values (FRV) from the available data, provided that the minimum data requirements have been met. For example, derivation of a FAV for marine and estuarine waters requires acute toxicity data on at least eight families of marine organisms, including at least two families of chordates, five families of invertebrates, and one other family (such as a plant). The short-term CMC of the substance is then calculated by applying a safety factor (0.5) to the FAV. The lowest of the FCV, FPV, and FRV is used directly to establish the long-term mean concentration (the CCC). The criteria are then subjected to critical review to evaluate the completeness of the data and the appropriateness of the results.

When EPA developed surface water quality criteria in the 1980s, it was known that chromium VI was the form that was most readily absorbed by living organisms, and that the solubility and toxicity of chromium III in saltwater was low. A review of the literature on toxicity of chromium III to marine organisms in EPA (1980) listed no chronic studies and only two acute studies (oyster and crab zoea). The data were considered insufficient at that time to support development of an acute or chronic marine criterion for chromium III. A review of toxicity of chromium III to marine organisms yielded no new studies conducted since the original surface water quality criteria were developed. The available toxicity data are reviewed below.

The mean acute toxicity value for the oyster was 10,300 micrograms per liter ($\mu\text{g/L}$) of total recoverable chromium III (Calabrese 1973, as cited in EPA 1980); the mean acute value for crab zoea was 56,000 $\mu\text{g/L}$. Based on these data, EPA (1980, page B-7) concluded that "probably because of precipitation, a large amount of trivalent chromium must be added to saltwater to kill aquatic organisms." For example, polychaete worms exposed to 50,400 $\mu\text{g/L}$ were killed, likely caused by a drop in pH from chromium precipitation. When pH was held stable, the worms survived and reproduced at the 50,400 $\mu\text{g/L}$ exposure concentration (Mearns and others 1976, as cited in EPA 1980).

In a review of chromium III hazards to marine organisms, Eisler (1986) listed a range of acute toxicity values from 3,300 $\mu\text{g/L}$ (fish 96 hours) to 56,000 $\mu\text{g/L}$ (crab 96 hours). The only chronic value available (12,500 $\mu\text{g/L}$) was based on a 21-day test of the polychaete worm *Nereis (Nenthes) arenaceodentata*. In acute tests, this polychaete was the most sensitive species tested.

The lack of chronic marine data for chromium III requires that some assumptions be made to derive a surface water quality criterion for this metal. Acute criteria are typically reduced by 80 percent to make acute surface water quality criteria more appropriate for use in chronic exposure scenarios (EPA 1986). The table below presents acute toxicity data for marine species exposed to chromium III adjusted for chronic exposure. The lowest chronic value for chromium III in

marine water (400 µg/L) was selected as the water quality criterion for Parcel B. Use of chronic instead of acute criteria and use of the lowest estimated chronic value add a further degree of conservatism to the assessment, as agreed to with the regulatory agencies.

Chromium III Toxicity to Marine Organisms			
Exposure		Effect	Reference
Acute (µg/L)	Estimated Chronic* (µg/L)		
2,000 to 105,000	400 to 21,000	Mean acute toxicity, multiple species	EPA 1980
3,300 to 56,000	660 to 11,200	Acute (96 hours) toxicity, multiple species	Eisler 1986
10,300	2,060	Acute toxicity to American oyster	Calabrese 1973, in EPA 1980
None	12,500 (actual chronic exposure)	Toxicity to <i>Neanthes arenaceodentata</i>	Eisler 1986
50,400	10,080	No effect on survival or reproduction in polychaete	Mearns and others, as cited in EPA 1980

Note:

* Acute to chronic adjustment defined as a reduction of the acute level by 80 percent (EPA 1986).

12.3 CONSIDERATION OF AMBIENT GROUNDWATER CONCENTRATIONS

As described in Section 12.1, the water quality criteria are probabilistic values derived specifically to protect marine organisms at a predetermined level of risk. Navy policy requires that regional background, or ambient, concentrations of chemicals be explicitly considered when chemicals of potential ecological concern (COPEC) are identified (Navy 2004). The higher of the water quality criterion or the HGAL was selected as the water quality screening criterion that was used to identify COPECs to avoid naming as COPECs chemicals detected at a maximum concentration in groundwater that was less than the HGAL. HGALs for metals are included in the groundwater screening presented in Section 13.0.

13.0 GROUNDWATER SCREENING RESULTS

The data set used for the groundwater screening includes data from the most recent 12 samples from each well at Parcel B using samples collected through November 2004 (similar to the data set used for the human health risk assessment). Groundwater data are included from both the A-aquifer and the B-aquifer at Parcel B. (Refer to Section 2.2.4 of the TMSRA for a discussion of the hydrogeology of Parcel B, and see Figure 2-4 of the TMSRA for a cross section illustrating the aquifer relationships.) Groundwater data are available using the database tool in Appendix F, and the data are described as part of the human health risk assessment in Appendix A (see Sections A4.1 and A4.2). Maximum concentrations of chemicals detected in groundwater at Parcel B were compared with the surface water quality criteria identified in Section 12.0. When no surface water quality criteria were available, the chemicals were eliminated from the analysis. The chemicals in the following table were eliminated based on the lack of an established criterion for surface water quality.

Chemicals Eliminated Based on No Established Criterion for Surface Water Quality	
1,1,2-Trichloro-1,2,2-trifluoroethane	Chloroethane
1,1-Dichloroethane	Cobalt
2,4,6-Trichlorophenol	delta-BHC
2-Hexanone	Dichlorodifluoromethane
2-Methylnaphthalene	Endrin ketone
Acetone	Iron
Acetophenone	m,p-Xylene
alpha-BHC	Magnesium
Aluminum	Manganese
Antimony	Molybdenum
Barium	Potassium
Beryllium	Sodium
beta-BHC	Trichlorofluoromethane
Bis(2-ethylhexyl)phthalate	Vanadium
Calcium	Vinyl acetate
Caprolactam	Vinyl chloride
Carbon disulfide	Xylene (total)

Note:

BHC Benzene hexachloride

Chemicals detected at maximum concentrations that exceeded surface water quality criteria were identified as COPECs. Eleven metals (see Table I-2); one volatile organic compound, trichloroethene (see Table I-3); one semivolatile organic compound, pentachlorophenol (see Table I-4); and four pesticides (see Table I-5) were identified as COPECs because they exceeded the surface water quality criteria in at least one sample with detected results.

Concentrations of the 17 COPECs in individual samples from each well were evaluated to identify potential threats to the bay, based on the following criteria:

1. Do measured concentrations consistently exceed surface water quality criteria during subsequent sampling events?
2. When was the most recent sample collected that exceeded the surface water quality criterion?
3. Can concerns about the COPEC be eliminated based on professional judgment of the extent and degree of the interpreted impact to the groundwater? The extent and degree of impact was assessed by reviewing the locations of recently measured concentrations, the likelihood that recently measured concentrations pose a threat to the bay, and concentration trends on a well-by-well basis.

These three evaluation criteria were applied on a well-by-well basis for each well with detectable concentrations of COPECs (see Table I-6). Every well that contained a COPEC that exceeded a surface water quality criterion is listed in Table I-6 to support the evaluation of the data for each COPEC at each well. Figure I-1 shows the locations of the wells listed in Table I-6.

13.1 CHEMICALS ELIMINATED AS CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN

Refinement of the list of COPECs focused on the trend in detections—especially consistent detections and whether the most recent samples from a well did not exceed the surface water quality criterion. Seasonal fluctuations also were considered in the data evaluation. The table below summarizes the 12 COPECs that were eliminated from further consideration based on the evaluation. Concentration data indicated that, for all 12 COPECs, detections that exceeded each surface water quality criterion were isolated and infrequent and were followed by at least one sample (but often several samples) that did not exceed the surface water quality criterion.

Chemical	Frequency Criterion was Exceeded	Table Reference	Date Criterion was Most Recently Exceeded*
Arsenic	5/425	I-2	Sep-04
Cadmium	3/416	I-2	Nov-95
Chromium (total)	5/462	I-2	Aug-94
Selenium	6/377	I-2	Sep-04
Silver	5/416	I-2	Sep-04
Zinc	13/437	I-2	Jun-02
Trichloroethene	2/489	I-3	Nov-02
Pentachlorophenol	1/237	I-4	Nov-02
alpha-Chlordane	2/234	I-5	Aug-03
gamma-Chlordane	2/234	I-5	Nov-03
Heptachlor	3/223	I-5	Mar-03
Heptachlor Epoxide	1/223	I-5	Nov-95

Note:

* See Table I-6 for chemicals that exceeded criteria

13.2 CHEMICALS OF CONCERN

Based on the well-by-well evaluation, chromium VI, copper, lead, mercury, and nickel were identified as chemicals of concern (COC). Each chemical is considered a COC only in the well where it exceeds the corresponding surface water quality criterion and not in any other well, or across Parcel B.

I3.2.1 Chromium VI

Chromium VI was identified as a COC because it was detected at concentrations that exceeded the chronic surface water criterion (50 µg/L) in samples collected from a single well. Of 354 groundwater samples collected at Parcel B, 10 contained concentrations that exceeded the surface water criterion for chromium VI (see Table I-2). All of the samples with elevated chromium VI concentrations were collected from well IR10MW12A near Building 123, where there was a known source of chromium VI from plating operations (see Table I-6).

I3.2.2 Copper

Copper was identified as a COC because it was detected at concentrations that exceeded the HGAL (28.04 µg/L) in samples collected from one well in IR-07. Of the 437 groundwater samples analyzed for copper, 7 exceeded the HGAL for copper. Table I-6 shows elevated concentrations of copper in the samples from well IR07MW20A2 (see Figure I-1).

I3.2.3 Lead

Lead was identified as a COC because it was detected at concentrations that exceeded the HGAL (14.44 µg/L) in samples collected from the IR-07 and IR-26 areas of Parcel B. Of the 426 groundwater samples analyzed for lead, 7 exceeded the HGAL for lead. Table I-6 shows elevated concentrations of lead in samples from wells IR07MWS-2 and IR26MW48A (see Figure I-1).

I3.2.4 Mercury

Mercury was identified as a COC because it was detected at concentrations that exceeded the HGAL (0.6 µg/L) in samples collected from the IR-07 and IR-20 areas of Parcel B. Of the 436 groundwater samples analyzed for mercury, 13 exceeded the HGAL for mercury. Table I-6 shows elevated concentrations of mercury in samples from wells IR26MW47A, PA50MW02A, and IR20MW01A (see Figure I-1). Mercury in the area beneath former Excavation EE-05 may be the source of the consistent mercury concentrations detected in samples from well IR26MW47A.

I3.2.5 Nickel

Nickel was identified as a COC because it was detected at concentrations that exceeded the HGAL (96.48 µg/L) in samples collected from several wells in the IR-07 area of Parcel B. Of the 415 groundwater samples collected at Parcel B wells, 19 exceeded the HGAL for nickel. Table I-6 shows elevated concentrations of nickel in samples from wells IR07MWP-1, IR07MWP-2, IR07MWS-1, IR07MWS-3, and IR07MWS-4D (see Figure I-1). Four of the five wells (all except IR07MWS-1) are located near San Francisco Bay in an area where groundwater contains high concentrations of chloride. All four wells were installed using stainless steel casing and well screens. The Navy studied the concentrations of nickel in the A-aquifer

groundwater near these wells by installing and sampling adjacent wells with polyvinyl chloride (PVC) casing and screens. Groundwater samples collected from wells constructed with PVC materials did not indicate elevated concentrations of nickel and the Navy concluded that the source of nickel in these wells was leaching of nickel from the well casing and screen caused by corrosion of the stainless steel well components in the high-chloride groundwater environment (IT Corporation 1999). These stainless steel wells have all since been decommissioned. Therefore, nickel was excluded as a COC in these four wells because the nickel concentrations of concern were not related to groundwater conditions in the aquifer.

Nickel was identified as a COC at well IR07MWS-1 because three samples exceeded the HGAL. Table I-6 shows elevated concentrations of nickel in samples from well IR07MWS-1 (see Figure I-1). Although well IR07MWS-1 was also constructed using stainless steel casing and well screen, this well was not included in the nickel study at IR-07 discussed above and concentrations of chloride in groundwater near IR07MWS-1 are lower than in the vicinity of the other four wells which are nearer to the bay than IR07MWS-1. Therefore, nickel was identified as a COC and included in the trigger level evaluation.

14.0 LINES OF EVIDENCE FOR ATTENUATION OF CHEMICAL CONCENTRATIONS IN GROUNDWATER

As chemicals migrate through soil and groundwater, they are subjected to physical, chemical, and biological processes that tend to reduce their concentrations. These processes include sorption of chemicals to soil particles, volatilization, hydrodynamic dispersion and molecular diffusion, and chemical and biological transformation (biodegradation).

Additional reduction in chemical concentrations takes place in the tidal mixing zone near the shoreline. This zone is where surface water from the bay moves inland through the aquifer, mixing with the groundwater. The net discharge of groundwater may not be changed by tidal influence, but rising tides introduce surface water into the aquifer so that the concentration of chemicals in groundwater that discharges during low tide is reduced by near-shore mixing of the bay water and groundwater in the aquifer. Finally, concentrations of chemicals entering the bay with the discharging groundwater will be further reduced by dilution of groundwater with the bay water at the interface of the groundwater and the bay. This section describes attenuation of chemical concentrations in groundwater as it migrates through these three different zones: from the source areas, through the tidal mixing zone, and on to the bay discharge points. As described below, in this evaluation the attenuation factors (AF) for the tidal mixing zone and for discharge to the surface water body are set to 1 (no attenuation) to provide a highly conservative approach, as agreed to with the regulatory agencies.

14.1 ATTENUATION DURING GROUNDWATER TRANSPORT TO TIDAL MIXING ZONE

Groundwater modeling was performed to estimate peak concentrations of chemicals that may discharge to the bay for a variety of plume widths and distances to the bay. The methodology and results for the groundwater modeling are presented in Appendix G of the Revised Feasibility Study Report for Parcel D (SulTech 2007). Based on the maximum detected concentration in

the source area and the predicted peak concentration at the point of discharge to the bay, an attenuation factor ($AF = \text{maximum source area concentration} / \text{predicted peak concentration at receptor location}$) was calculated for the various hypothetical groundwater plumes.

The analytical solute transport model BIOSCREEN (EPA 1997a) was used to predict maximum concentrations at the point of discharge and then to calculate AFs. The sediment/bay interface was used as the point of discharge in the model. BIOSCREEN can simulate adsorption and degradation processes during advective transport of the solute; however, adsorption and degradation parameters were set to zero in this model to ensure that hydrodynamic dispersion was the only mechanism acting to reduce contaminant concentrations in groundwater. By modeling hydrodynamic dispersion as the only attenuation mechanism, the results can be applied to any analyte and the calculated AFs are not chemical specific; however, the AFs are plume specific based on the width of the plume and the distance from the source of the plume to the nearest receptor location. Considering only hydrodynamic dispersion for attenuation adds conservatism to the assessment, as agreed to with the regulatory agencies.

The intent of this modeling approach was to provide conservative estimates of the maximum concentrations in groundwater expected at the points of discharge. Based on model sensitivity analysis, the values for input parameters were chosen to result in realistic, yet conservatively high, estimates of the maximum concentrations in groundwater at the points of discharge, providing an added layer of conservatism to the calculations. The results of the modeling indicated a range of AFs, depending on the width of the plumes and the distance to receptors. A complete presentation of the modeling methodology and results is provided in the Revised Feasibility Study Report for Parcel D (SulTech 2007).

The table on the following page provides typical ranges of AFs calculated using the BIOSCREEN model for various plume widths and distances from the bay. These data indicate that the amount of attenuation caused by hydrodynamic dispersion during groundwater transport can be significant, and the longer the travel distance (distance to receptor) the greater the AF.

14.2 ATTENUATION IN THE TIDAL MIXING ZONE

Several studies in the vicinity of HPS attempted to quantify the amount of attenuation that occurs in the tidal mixing zone caused by dilution by seawater. These studies are discussed below.

The tidal mixing zone is defined as the area near and inland of the shoreline where groundwater and sea water mix as a result of tidal fluctuations. Groundwater flow in the tidal mixing zone can be complex because of the diurnal nature of tides. At high tide, the flow direction may be from the shore inland, in response to the hydraulic gradient created by the high tide. Conversely, at low tide, the flow direction may be from land to the shore, in response to the hydraulic gradient created by the low tide. The tidally influenced fluctuations in water level change the direction of groundwater flow daily in the tidal mixing zone, and result in the movement of seawater back and forth in the tidal mixing zone. Assuming concentrations are lower in the sea water than the groundwater that is discharging, a certain amount of attenuation of chemical concentrations in groundwater occurs because of the dilution of groundwater within the aquifer by the sea water.

Source Width (feet)	Distance to Receptor (feet)	Attenuation Factor
40	50	1.0
40	500	6.3
40	1,600	58.0
60	50	1.0
60	500	4.4
60	1,600	40.4
80	50	1.0
80	500	3.4
80	1,600	31.5
120	50	1.0
120	500	2.5
120	1,600	22.6
160	50	1.0
160	500	2.1
160	1,600	18.1
200	50	1.0
200	500	1.9
200	1,600	15.3
240	50	1.0
240	500	1.8
240	1,600	13.5
280	50	1.0
280	500	1.8
280	1,600	12.2
320	50	1.0
320	500	1.7
320	1,600	11.3
360	50	1.0
360	500	1.7
360	1,600	10.5

14.2.1 Modeling Conducted at Mission Bay, San Francisco

A one-dimensional mathematical model (ENVIRON International Corporation 1998) was developed for the area within a 50-foot distance from the bay fringe. The model simulated the influence of tides on chemical concentrations in groundwater as the groundwater flows toward the bay and was based on method developed by Yim and Mohsen (1992). The model incorporated the effects of dilution, hydrodynamic dispersion, and sorption within the groundwater system. No dilution within the bay was considered. In total, 63 model runs were carried out to provide a sample of reasonable dispersivity characteristics, sorption parameters, and initial concentration distributions. The minimum attenuation predicted by the model over the last 50 feet to the bay was a factor of about 6.5, the maximum attenuation was 12.8, and the average attenuation was 9.7. As additional support for the model results, the authors used the real case where the tidal influences reduced the highest observed contaminant level inland of 600 µg/L to about 15 µg/L near the tidal river (which results in an AF of 40).

14.2.2 Modeling Conducted Near Pier 64, San Francisco

Clayton Group Services (2001), in association with S.S. Papadopoulos & Associates, Inc., developed a flow and transport model using MODFLOW and MT3D to evaluate attenuation of chemical concentrations in groundwater caused by dilution associated with tidal mixing in the fill close to the bay. The base case model showed a 65 percent reduction (approximately a factor of 3) in the average concentration of chemicals in groundwater before it enters the bay, which is a more conservative result than was obtained from the model developed for Mission Bay. However, the estimated inland extent of mixing was only 30 feet into the aquifer from the bay, as opposed to the 50 feet used for the Mission Bay model. Additionally, the Pier 64 model used a much higher hydraulic conductivity value (75 feet per day) than the Mission Bay model (2.8 feet per day). Data from HPS studies indicate that the tidal mixing zone is longer than 50 feet and that hydraulic conductivities are generally on the order of 1 to 20 feet per day. Therefore, it appears that the modeling results from Mission Bay would be more representative of the conditions at HPS than the modeling results from near Pier 64.

14.2.3 Tidal Mixing Study at Hunters Point Shipyard

The Navy studied the extent of tidal mixing within the A-aquifer at Parcel E at HPS in 2002 (Tetra Tech 2004). Specific conductance, a temperature-independent surrogate for salinity, was used to evaluate the relationship between salinity fluctuations and tidal fluctuations. Fluctuations in specific conductance related to tidal fluctuations in water levels were observed along the Parcel E shoreline in a near-shore well (IR02MW206A1 located 70 feet from the bay in the area east of IR-03), but not in an inland well (IR15MW06A located 335 feet from the bay at IR-15). These data indicate that the tidal mixing zone in Parcel E extends at least 70 feet inland from the shoreline.

14.3

ATTENUATION ON DISCHARGE TO SAN FRANCISCO BAY

When groundwater discharges to the bay, chemical concentrations in groundwater likely are diluted because of the relatively small volume of groundwater discharging into a large surface water body. However, measuring groundwater discharge is a difficult task and is seldom attempted at hazardous waste sites. It is also difficult to measure the chemical concentrations in the surface water body because of uncertainty about locations and depths for sampling and potential temporal variations in concentrations. Several agencies have assumed a 10 times dilution factor as a "rule of thumb" to account for the dilution in chemical concentrations that occurs when groundwater discharges to a surface water body. The following sections describe the approaches that these regulatory agencies have taken.

14.3.1 National Oceanic and Atmospheric Administration Approach

The Coastal Protection and Restoration Division (CPRD) of National Oceanic and Atmospheric Administration (NOAA) is charged with protecting and restoring coastal habitats and resources affected by hazardous materials releases. CPRD works closely with EPA, the Department of Defense, states, and other natural resource trustees throughout the Comprehensive Environmental Response, Compensation, and Liability Act remedial process to ensure that selected remedies are protective and that appropriate measures are implemented to restore NOAA trust resources (NOAA 2006a).

CPRD developed Screening Quick Reference Tables that present screening concentrations for inorganic and organic chemicals in various environmental media (NOAA 1999). The CPRD discusses the comparison of screening of groundwater data to EPA's ambient water quality criteria (AWQC) on the Frequently Asked Questions web page, as follows (NOAA 2006b):

"Groundwater concentrations are also screened against AWQC (ambient water quality criteria). However, given the dilution expected during migration and upon discharge of groundwater to surface water, CPRD uses 10 times the applicable AWQC for screening."

Why does NOAA apply a default dilution factor of only 10x for the discharge of groundwater to surface water?

"We prefer to use site-specific information whenever it is available. But because such data have not been derived, we acknowledge that some level of dilution would occur. We chose to use a conservative, order of magnitude dilution factor for screening purposes to ensure a high degree of confidence that any contaminant source eliminated from further consideration is not likely to pose substantial risk. Conversely, this is not meant to imply that contaminant sources that do not pass this screening do pose risk."

The information presented on NOAA's website indicates that NOAA considers a 10 times dilution of groundwater concentrations during transport and discharge to surface water to be an appropriate, conservative estimate of the amount of attenuation in chemical concentrations that can be expected when groundwater discharges to a surface water body.

14.3.2 EPA RCRA Approach

The Resource Conservation and Recovery Act (RCRA) grants EPA and authorized states the authority to regulate hazardous waste management facilities that treat, store, or dispose of hazardous waste. The RCRA corrective action program uses environmental indicators (EI) to assess progress at RCRA sites. The EIs are a means of evaluating and reporting on the acceptability of current site conditions. (That is, they are interim milestones and not final remedy or site closure goals.) They are used to summarize and report on the site-wide environmental conditions at the RCRA corrective action program's highest-priority sites (especially on the RCRA Cleanup Baseline). One of the EIs is "Migration of Contaminated Groundwater under Control" (the "groundwater EI").

The following information is provided on the EPA RCRA Corrective Action Environmental Indicators — Frequently Asked Questions web page (EPA 2006b).

For the purpose of making a Groundwater Environmental Indicator determination, how do I address groundwater-to-surface-water interaction?

"In cases where groundwater is being discharged to surface water, you should, as a general matter, focus your groundwater environmental indicator evaluation on the question of whether or not contaminated groundwater is significantly impairing the quality of the surface water body. A positive environmental indicator determination would generally be appropriate where the groundwater is not significantly affecting the surface water body in a way that leads it to fail basic water-quality criteria."

Is the discharge of "contaminated" groundwater into surface water likely to be "insignificant?"

"In some cases, overseeing agencies are likely to be able to conclude that a release from groundwater into surface water will be "insignificant" – and therefore "under control" – based on the levels of contaminants in the groundwater, without consideration of the volume or flow of the surface water body. As a rule of thumb, we have found that, if the groundwater concentrations for all constituents are less than 10 times the appropriate surface water quality criteria for both human health and aquatic life, the current groundwater discharge should be "insignificant" for environmental indicator purposes. In this case, the regulator would conclude that the groundwater environmental indicator had been met (at least with respect to the discharge to surface water)."

The information provided in the interim-final guidance and on the RCRA corrective action program's web pages clearly indicates that it is appropriate for RCRA sites to assume a 10 times dilution factor in estimating concentrations of contaminants in groundwater discharging into surface water bodies (EPA 2006b, 2006c).

14.3.3 Regional Water Quality Control Board, San Francisco Bay Region Approach

The Water Board has allowed a 10 times dilution and attenuation factor in at least one instance: for the proposed Eastshore Park Property in Berkeley, Albany, and Richmond. In Site Cleanup Requirements Order No. 98-072 for Catellus Development Corporation and SF Pacific Property, Inc., the Water Board states: "Action levels for groundwater are based on water quality objectives for saltwater species...In the uplands above the 50-foot shoreline buffer, groundwater action levels are ten times the water quality objectives. This multiple reflects the predicted attenuation of constituents in groundwater that occurs at the site as discussed in the Remediation and Risk Management Plan, given the chemical-specific characteristics, site-specific hydrogeological conditions, and the Board's prior experience with groundwater at various shoreline sites."

The Water Board's position related to the Eastshore Park Property is that the 10 times dilution was a site-specific determination and is not directly applicable to HPS. The Water Board does not allow modeling to incorporate dilution of groundwater contaminants in surface water. The Water Board's position regarding attenuation of groundwater discharge to the bay at HPS is further discussed in a letter to the Navy dated March 16, 2006 (Water Board 2006b).

14.4 SUMMARY OF ATTENUATION MECHANISMS FOR CHEMICALS IN GROUNDWATER

Chemical concentrations in groundwater are reduced in three discrete zones during groundwater transport from a source zone to the bay. These are (1) the area of groundwater transport to the tidal mixing zone, (2) the tidal mixing zone, and (3) the zone of groundwater discharge to the bay. The mechanisms of attenuation and amount of attenuation in each of these three zones are different. As described below, in this evaluation the AFs for the tidal mixing zone and for discharge to the surface water body are set to 1 (no attenuation) to provide a highly conservative approach, as agreed to with the regulatory agencies.

Mechanisms such as sorption, biological and chemical transformation, and hydrodynamic dispersion are at work during groundwater transport. Groundwater flow modeling conducted for Parcel D evaluated the amount of attenuation that would be expected created only by hydrodynamic dispersion in the groundwater transport zone. Under conservative assumptions (see Revised Feasibility Study Report for Parcel D [SulTech 2007]), the amount of attenuation that occurred ranged from a factor of 1 to 58, depending on the width of the source area and the distance to the bay. For small plume widths (40 feet), and distances of 500 feet and greater, AFs were greater than 6. For relatively large plume widths (170 feet) and distances of 500 feet and greater, AFs were greater than 2, and at distances of 1,000 feet, AFs were greater than 4,

even with plume widths up to 340 feet. The COC plumes identified at Parcel B were generally on the order of 40 feet wide and were between 50 and 300 feet from the bay.

Within the tidal mixing zone, at least two studies have been performed in the San Francisco Bay area, which indicated that dilution of chemical concentrations occurs in this zone. The Mission Bay study indicated AFs of 6.5 to 12.8, with an average value of 9.7 within a 50-foot tidal mixing zone. The study conducted near Pier 64 indicated a 65 percent reduction (AF of 3) in chemical concentrations within a 30-foot tidal mixing zone. Tidal mixing studies conducted at HPS have indicated a tidal mixing zone of at least 70 feet. The hydraulic conductivities used for the Mission Bay and Pier 64 studies indicate that the Mission Bay study more closely reflects conditions at HPS.

When groundwater discharges into a surface water body, it is expected that some dilution of chemical concentrations in groundwater will occur because of the much larger volume of water in the surface water body as compared with the volume of groundwater discharge. However, measuring the actual amount of dilution that occurs on groundwater discharge is difficult. NOAA, EPA, and the Water Board have all indicated that a 10 times dilution or attenuation “rule of thumb” is appropriate to evaluate concentrations in groundwater upland of the point of discharge and the potential for this groundwater to impair the surface water body. All three agencies have indicated they consider the 10 times rule a conservative assessment of the amount of dilution that can be expected.

The amount of attenuation that occurs in each of these zones is not additive — it is multiplicative. However, in this evaluation, the AFs for the tidal mixing zone and for discharge to the surface water body are set to 1 (no attenuation) to provide a highly conservative approach, as agreed to with the regulatory agencies.

15.0 DEVELOPMENT OF PARCEL B TRIGGER LEVELS

This section presents proposed trigger levels developed for each of the COCs identified in Section 13.0. The trigger level development takes an extremely conservative approach because it does not take into account attenuation in the tidal mixing zone or attenuation from discharge to the surface water body, and instead relies exclusively on the hydrodynamic dispersion calculated for the groundwater transport zone. Considering only hydrodynamic dispersion for attenuation adds conservatism to the assessment, as agreed to with the regulatory agencies. The resulting trigger levels likely overestimate the potential impacts of the groundwater plumes on the bay.

Wells that have concentrations of metals above the water quality screening criterion have been identified at Parcel B in the following areas:

- IR-07, copper, lead, and nickel
- IR-10, chromium VI
- IR-20, mercury
- IR-26, lead and mercury

Trigger levels can be derived for these source areas by multiplying the AF calculated for the source area by the surface water quality criteria or the HGAL, whichever is higher. The modeling approach and resultant AFs are described in detail in the Revised Feasibility Study Report for Parcel D (SulTech 2007) and summarized in Section I4.1. The table below summarizes the proposed trigger levels for each well and COC.

Well, COC	Attenuation Factor	HGAL (µg/L)	Surface Water Quality Criterion (µg/L)	Proposed Trigger Level at Source Well (µg/L)	Concentration at Source Well (µg/L)	Date of Sample	Concentration Exceeds Proposed Trigger Level?
IR07MW20A2, copper	1	28.04	3.1	28.04	40.6	Jul-91	YES
IR07MWS-1, nickel	4	96.48	8.2	386	322	Dec-91	NO
IR07MWS-2, lead	1	14.44	8.1	14.44	114	Sep-04	YES
IR10MW12A, chromium VI	4.5	NA	50	225	550	Mar-04	YES
IR20MW01A, mercury	4	0.6	0.025	2.4	2	Jan-94	NO
IR26MW47A, mercury	1	0.6	0.025	0.6	2.8	Nov-04	YES
IR26MW48A, lead	1	14.44	8.1	14.44	71.5	Sep-04	YES
PA50MW02A, mercury	1	0.6	0.025	0.6	0.91	Aug-94	YES

Note:

NA Not applicable

These proposed trigger levels are extremely conservative because (1) they rely on conservative AFs calculated from groundwater flow modeling and (2) they take into account only hydrodynamic dispersion during groundwater transport and do not include attenuation in the tidal mixing zone or attenuation when the groundwater discharges to the surface water body. Considering only hydrodynamic dispersion for attenuation adds conservatism to the assessment and provides maximum protectiveness for the bay, as agreed to with the regulatory agencies. Nevertheless, the six wells listed above where the concentration exceeds the proposed trigger level will be included in the proposed groundwater monitoring plan discussed in Section 5.3.2 of the TMSRA.

As discussed in Section 5.3.2 of the TMSRA, the details of groundwater monitoring program will be identified during the remedial design. Inclusion of the six wells listed above in the groundwater monitoring program will be based on the concentrations observed in groundwater at these wells at the time the design is prepared. The groundwater data used for some of these wells was collected many years ago and may no longer represent current conditions in groundwater. For example, the concentration of copper at well IR07MW20A2 that exceeded the trigger level was measured in a sample collected in 1991, and this well was not sampled since

that time. Evaluations in the remedial design will consider current data for the six wells listed above and will not be limited to the data set ending in November 2004 that was used for the trigger level analysis. These newer data collected since November 2004 may indicate that monitoring is no longer necessary (for example, if the data show concentrations are consistently below the trigger level). Wells that were installed after the cut-off date for the trigger level evaluation (November 2004) will also be included in the assessment during the remedial design. Complete discussions of these evaluations will be contained in the remedial design for review by the regulatory agencies.

For the cases where the current data indicate concentrations consistently exceed a trigger level, the following additional evaluations may occur:

- Increasing the frequency of monitoring in the well where the trigger level was exceeded to evaluate whether the elevated level is persistent;
- Monitoring groundwater at a location farther downgradient to evaluate whether the attenuation estimated in establishing the trigger level has occurred;
- Using site-specific detailed information to more accurately estimate attenuation (including processes such as adsorption and degradation); or
- Implementing a selected remediation alternative for groundwater treatment.

Chemicals that are identified in the remedial design as requiring monitoring based on the trigger levels will follow a process similar to the process envisioned for other COCs (such as volatile organic compounds and mercury) in groundwater that is described in Section 5.3.2 of the TMSRA. This process will include regular monitoring followed by a “proof period” to demonstrate that concentrations are below the trigger level. Details of the groundwater monitoring plan will be developed during the remedial design but are expected to include criteria (perhaps as a decision-tree matrix) to guide decisions for active treatment of groundwater in a case where a chemical concentration consistently exceeds a trigger level.

Trigger levels apply only to specific locations and chemicals; the point of measurement for comparison to a trigger level will be an individual groundwater monitoring well. In some cases, the point of measurement may be a well near the shoreline. For COCs that exist in groundwater near the shoreline, the chemical concentrations in groundwater at the point of measurement will be used to represent the concentrations that exist farther bayward at the interface of the sediment and the surface water of the bay where groundwater discharges (the point of exposure).

The uncertainty involved in the development of the trigger levels is described in the following section.

16.0 UNCERTAINTY

Uncertainty plays an important role in risk-based decision-making. By design, a screening-level evaluation is centered on conservative default assumptions that result in overestimates of risk (EPA 1997b). The sections below include brief reviews of some sources of uncertainty associated with development of trigger levels for Parcel B groundwater.

16.1 UNCERTAINTY IN DEVELOPMENT OF WATER QUALITY SCREENING LEVELS

The water quality screening criteria for aquatic life are derived using a methodology published in "Guidelines for Deriving Numeric National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" (Stephan and others 1985). Under these guidelines, criteria are developed from data that quantify the sensitivity of species to toxic compounds in controlled studies. Almost all of the data used to derive the criteria are from studies on animals and plants under controlled laboratory conditions. Criteria are generally not adjusted for laboratory-to-field variance.

It is possible to conduct long-term sublethal laboratory tests to derive chronic water quality criteria. In reality, though, chronic toxicity tests are much more expensive than acute tests and are not as frequently conducted. Chronic toxicity testing data for many chemicals, such as chromium III, are inadequate to meet the minimum requirement of eight families of aquatic organisms to develop water quality criteria. In these instances, EPA allows the estimation of a chronic criterion from the FAV using ratios derived from studies that involved both acute and chronic tests simultaneously for the same species. Acute-to-chronic ratios are calculated for each set of parallel tests, then averaged (using the geometric mean) to arrive at the final acute-to-chronic ratio. The acute-to-chronic ratio is the ratio of the acute toxicity to the chronic toxicity of a chemical or sample that can be used to predict acute toxicity from chronic data and vice versa. Three studies with parallel testing are required to calculate a valid final ratio. The chronic criterion is then calculated from the FAV (and not the acute criterion) by dividing it by the final acute-to-chronic ratio. Although the protocol is well defined, the resulting chronic criterion may bear little relation to actual toxicity experienced by marine organisms in the field.

16.1.1 Speciation and Bioavailability of Chromium III in Receiving Water

Most states default to using the chromium VI criteria for all species of chrome because EPA does not provide criteria for chromium III in marine waters. However, chromium III is dramatically less toxic than chromium VI to polychaetes and crustaceans (but not to molluscs or teleosts) in saltwater (Eisler 1986). Given that chromium exists in two major valence states, depending on the presence of oxygen in the sediment and the water column of the receiving water body, it is essential to distinguish between chromium III and chromium VI. In addition, natural and induced remedies for chromium VI may result in increased chromium III concentrations as a degradation product. Generally, chromium III is relatively non-toxic in saltwater, and chromium VI is highly toxic. The current science indicates that reduction/oxidation (redox) conditions present within the water column and sediment govern the chemistry of chromium, as a recent investigation in Baltimore Harbor has demonstrated (Maryland Department of the Environment

2004). In Baltimore Harbor, low dissolved oxygen in the water column and high biological oxygen demand in the sediment drove the conversion of chromium VI to chromium III (Maryland Department of the Environment 2004). Much of the chromium III adsorbed to the sediment, where it was involved in reactions that created stable oxides and hydroxides that were unavailable for partitioning into porewater (Maryland Department of Environment 2004).

Uncertainty related to speciation of chromium in receiving waters is not a trivial variable. Sensitivity of marine organisms to chromium VI and chromium III varies by several orders of magnitude. *Neanthes arenaceodentata*, a marine polychaete worm, is the most sensitive marine organism reported in the literature (Eisler 1986). Concentrations of chromium VI of less than 100 µg/L interfered with feeding, reproduction, and larval development (Eisler 1986). Yet this same marine species demonstrated no adverse reaction to concentrations of chromium III more than 3 orders of magnitude greater than the effect level of chromium VI.

The two forms of chromium differ markedly in their availability to marine organisms. Chromium III is not readily taken up by organisms because of its very low solubility in saltwater. Barnacles (*Balanus* sp.) accumulated chromium VI in their tissues at concentrations up to 1,000 times greater than ambient concentrations. In contrast, chromium III was quickly removed by the filtering activity of the barnacle and was not concentrated in soft tissues. Instead, the barnacle eliminated chromium III via the digestive system, according to studies reported in Eisler (1986).

Studies such as these illustrate the uncertainties associated with chromium toxicity. Except for the area near well IR10MW12A where chromium VI is known to be present, groundwater conditions (especially pH and redox potential) at Parcel B favor the existence of chromium as chromium III. Nevertheless, detailed studies of chromium in groundwater throughout Parcel B have not been conducted, so the speciation of chromium is an uncertainty.

16.1.2 Speciation and Bioavailability of Nickel in Receiving Water

The ultimate fate of nickel in the bay is controlled by physical and chemical properties of the surface water, including pH, redox potential, hardness, alkalinity, organic and inorganic ligands, other cations that compete for binding sites, water temperature, and other factors.

The actual bioavailability and toxicity of dissolved nickel released in groundwater to San Francisco Bay cannot be predicted using available data. The water quality criterion is lower than the background concentration of nickel in groundwater at Parcel B. Local conditions may favor organisms that are tolerant to nickel, or organisms that are sensitive to the toxic effects of nickel may not be as prevalent in the area. No site-specific tests of nickel toxicity were conducted, so this question remains unanswered. It is well known, however, that the background concentration of nickel in San Francisco Bay sediment derived by the Water Board is higher than the effects range generally used to screen risk to estuarine organisms throughout the country (Long and others 1995; Water Board 1998).

The toxicity benchmarks for nickel, which are based on laboratory tests using specially constituted water, may be poor predictors of toxicity observed in the bay because the composition of water used for marine testing has a substantial influence on the outcome of the test. This influence results because of the large number of parameters that interact to control the bioavailability of the metal ion, allowing it to enter the organism or be adsorbed onto external membranes (Nickel Institute 2006). Use of the HGAL as the water quality screening level circumvents the issue of uncertainty in the toxicity benchmark, but does not provide a risk-based substitute for predicting or interpreting actual effects on the marine environment.

16.2 UNCERTAINTY IN DERIVING ATTENUATION FACTORS

The derivation of AFs for chromium VI, copper, lead, mercury, and nickel in the Parcel B groundwater relies on estimates of physical, chemical, and biological conditions that prevail below the surface of the ground across a wide area of heterogeneous fill material. Processes such as sorption of contaminants to soil particles, volatilization, hydrodynamic dispersion and molecular diffusion, and chemical and biological transformation are complex and are difficult to precisely quantify, even under controlled laboratory conditions.

General trends, such as the tendency for chemical concentrations to decrease as the groundwater moves away from the source of contamination, are understood; still, the precise measurements of the parameter values desired in the model are rarely available. Instead, conservative default values are substituted, or in some cases, a range of values is applied in an effort to bracket the correct value. For example, in the model described in the Revised Feasibility Study Report for Parcel D (SulTech 2007) and summarized in Section 14.1 of this appendix, adsorption and degradation parameters were set to zero to ensure that hydrodynamic dispersion was the only mechanism that could cause a reduction in chemical concentrations in groundwater. This approach likely underestimates the reduction in contaminant concentrations and results in conservatively low AFs.

The data set used to derive the AFs adds some additional uncertainty. In some cases, few measurements were collected at a location or the only data available were collected many years ago. Both of these factors may limit the representativeness of the data evaluated for these wells. However, data for all wells were considered in the evaluation and trigger levels were developed despite these limitations. For example, a trigger level was calculated for copper at well IR07MW20A2 even though only three samples were collected and the most recent was collected in June 1992.

Often, the uncertainty in site-specific conditions is implicitly addressed in the decision not to attempt to quantify attenuation, but to default to a conservative value, such as the 10 times dilution recommended by NOAA (1999). The default value acknowledges the inherent uncertainty in site-specific conditions, and is intended to bias the decision-making process toward increased protectiveness. In some cases, the purposeful bias in parameter values used for the Parcel B assessment resulted in AFs that are even more conservative (lower) than the 10 times factor typically used by regulatory agencies (see Section 14.1).

16.3

UNCERTAINTY IN CALCULATING TRIGGER LEVELS

Calculation of a trigger level for groundwater is a simple multiplication of the AF by the water quality screening level. However, as a product of two terms that are each the result of a series of estimates, the trigger level carries with it the uncertainties of the individual terms that contributed to the final equation. As discussed in Sections 16.1 and 16.2, neither the water quality criteria nor the AF are easily derived, exact, or realistic quantities. On the contrary, these values are themselves derived via a process of estimation and back-calculation that contains its own inherent uncertainty.

Even if it were assumed that both the surface water quality criteria and the AF were accurately estimated, the assumptions in the trigger level calculation would introduce additional uncertainty in the form of purposeful bias toward conservatism. The underlying assumption in development of the trigger level is that the most sensitive life stage of the most sensitive marine organism known is exposed for its entire lifetime to the maximum concentration of a chemical in groundwater, reduced only by the conservatively calculated AF. The calculation also assumes that 100 percent of the chemical remains in the dissolved state even after it has been discharged to the bay, despite expectations that some constituents may be quickly adsorbed to sediment or precipitate out.

17.0 SUMMARY AND CONCLUSIONS

Water quality criteria have been established for the protection of aquatic organisms in surface water, and generally exist for both acute and chronic exposure scenarios. These surface water quality criteria were evaluated, and appropriate surface water quality criteria for the protection of the bay were selected. Selection criteria included use of chronic criteria if available, use of acute criteria adjusted for chronic conditions if no chronic criteria exist, and selection of the lowest level of two criteria existing for the same exposure scenario.

No such criteria exist for groundwater. The direct application of the surface water quality criteria to groundwater to protect aquatic organisms from groundwater that discharges to a surface water body is inappropriate because chemical concentrations in groundwater will tend to attenuate as the groundwater migrates toward its discharge point. Furthermore, surface water quality criteria are not legally applicable to groundwater. However, the surface water quality criteria were applied to groundwater at Parcel B as screening levels to evaluate the potential for groundwater to affect the bay. This screening analysis found that chromium VI, copper, lead, and mercury were present at high enough concentrations to indicate a potential impact to the bay based on very conservative AF evaluations.

Three discrete zones exist for HPS along the groundwater migration pathway: (1) the zone of groundwater transport from the source area to the tidal mixing zone, (2) the tidal mixing zone, and (3) the zone of groundwater discharge to the surface water body. Attenuation in the zone of groundwater transport occurs based on hydrodynamic dispersion, sorption, and biological and chemical transformation. Attenuation in the tidal mixing zone occurs from these processes and by dilution from the mixing of bay water with groundwater as high tides cause bay water

to move inland into the aquifer. Attenuation in the groundwater discharge zone occurs primarily through dilution with the much larger volume of water present in the surface water body. In this evaluation, the AFs for the tidal mixing zone and for discharge to the surface water body are set to 1 (no attenuation) to provide a highly conservative approach, as agreed to with the regulatory agencies.

The amount of attenuation that occurs in each of these zones can be estimated, primarily using some type of modeling. Modeling results for the groundwater transport zone indicated that attenuation caused by hydrodynamic dispersion alone can be substantial, depending on the width of the plume and the distance to the discharge point. AFs calculated from the model ranged from 1 (for plumes traveling 50 feet to a discharge point) to 58 (for a small plume of 40-foot source width traveling 1,600 feet to a discharge point). AFs based solely on hydrodynamic dispersion estimated for the COCs at Parcel B ranged from 1 to 4.5.

Groundwater modeling performed to study the tidal mixing zone at other sites near HPS indicated AFs ranging from 3 to 12 for tidal mixing zones that were 30 to 50 feet from the shoreline. Although no other modeling efforts were identified to estimate the amount of dilution that occurs when groundwater discharges to the bay, EPA, NOAA, and the Water Board have indicated that a dilution or attenuation factor of 10 would be a conservative estimate of the amount of dilution that occurs when groundwater discharges to a surface water body. AFs calculated for Parcel B ranged from 1 to 4.5.

Plume-specific trigger levels were developed by multiplying the AFs calculated for the groundwater transport zone and the water quality criteria selected for the COCs, or the HGAL, whichever is higher. These trigger levels reflected extremely conservative assumptions, as follows:

1. The groundwater modeling for the transport zone assumed no sorption or biological or chemical transformation reactions and relied exclusively on hydrodynamic dispersion to simulate attenuation of chemical concentrations .
2. The AF did not include attenuation in the tidal mixing zone or attenuation when it discharges into the bay, and included only attenuation in the groundwater transport zone.
3. The water quality criterion selected for some metals (for example, chromium) was the chronic exposure scenario, even though the AF assumed that groundwater did not mix with the bay water. Under a no-mixing scenario, the appropriate water quality criterion would be the acute scenario, which typically is a higher number.

Nevertheless, the Navy agreed to use highly conservative measures throughout this evaluation, as agreed to with the regulatory agencies.

The groundwater monitoring plan for Parcel B will address the need for monitoring to confirm the concentrations in the plumes, the temporal stability of the plumes, and the degree, if any, that the plumes are migrating toward the bay. Chemical concentrations in groundwater exceeded trigger levels that were based on ARARs at six wells. Consequently, costs are included in the TMSRA (see Appendix D) for groundwater monitoring at these six wells (listed in Section I5.0). Four of these six wells were already selected in the TMSRA for groundwater monitoring based on other chemicals (for example, volatile organic compounds). However, as discussed in Section I5.0, not all of these wells may require monitoring, depending on the concentrations observed in groundwater at these wells at the time the remedial design is prepared. Wells that were installed after the cut-off date for the trigger level evaluation (November 2004) will also be included in the assessment conducted during the remedial design.

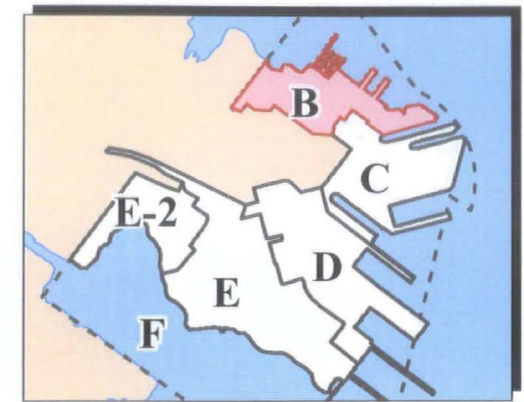
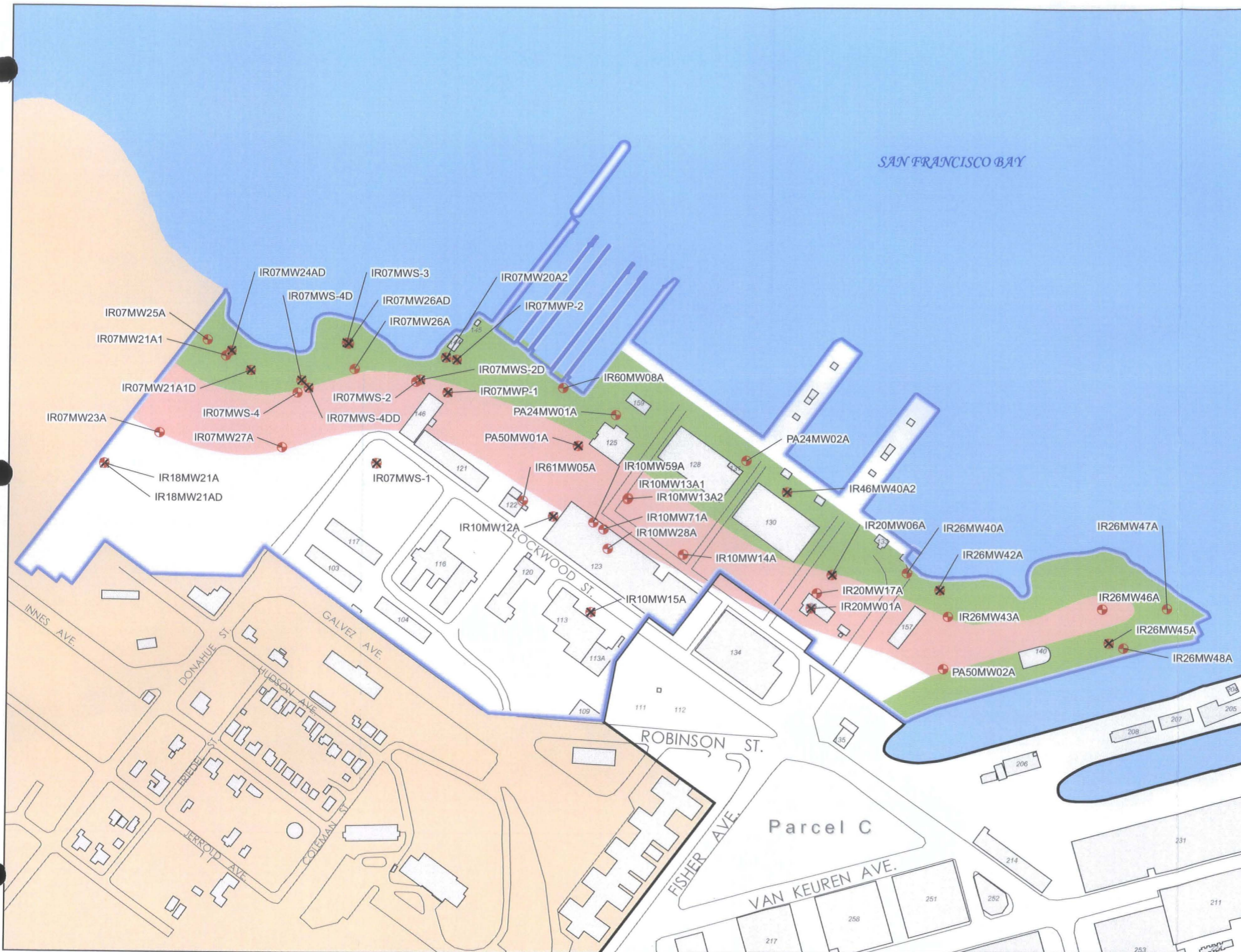
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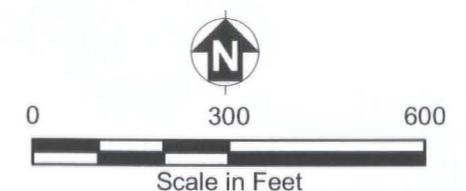
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FIGURES



Location Map

- Groundwater Monitoring Well
- ✕ Decommissioned Groundwater Monitoring Well
- Parcel B Boundary
- Other Parcel Boundary
- 128 Building
- Tidally Influenced Zone
- Five-Year Buffer Zone
- San Francisco Bay
- Non-Navy Property
- Road



Hunters Point Shipyard, San Francisco, California
U.S. Department of the Navy, BRAC PMO West, San Diego, California

**FIGURE I-1
MONITORING WELL
LOCATION MAP**
TMSRA for Parcel B

TABLES

TABLE I-1: SURFACE WATER QUALITY CRITERIA FOR THE SAN FRANCISCO BAY
Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Analyte	Pseudonym	San Francisco Bay Basin Plan ^a (µg/L)		California Toxics Rule Criteria for Enclosed Bays and Estuaries ^e (µg/L)				National Recommended Water Quality Criteria ^k (µg/L)		National Ambient Water Quality Criteria (AWQC) for Protection of Saltwater Aquatic Life ^l (µg/L)						Other Criteria (footnotes indicate source) (µg/L)		Selected Water Quality Criteria (µg/L)	
								Saltwater Aquatic Life				Lowest Observed Effect Level (LOEL)							
				Chronic ^g		Acute ^g		Instantaneous Maximum	Chronic ^g		Acute ^g		Chronic ^h		Acute ⁱ				Other ^j
				Concentration Footnotes		Concentration Footnotes	20% of Concentration ^f Footnotes	Concentration 10% of Concentration ^f Footnotes	Concentration Footnotes		Concentration Footnotes	20% of Concentration ^f Footnotes	Concentration Footnotes		Concentration Footnotes	20% of Concentration ^f Footnotes	Concentration Footnotes		Other Footnotes
1,1,1-Trichloroethane	1,1-Dichloroethylene	--	--	--	--	--	--	--	--	--	--	31,200	6,240	--	--	--	6,240		
1,1,2,2-Tetrachloroethane		--	--	--	--	--	--	--	--	--	9,020	1,804	--	--	--	1804			
1,1-Dichloroethene		--	--	--	--	--	--	--	--	--	224,000	44,800	(27)	--	--	44,800			
1,2,4,5-Tetrachlorobenzene		--	--	--	--	--	--	--	--	--	129	(22)	160	--	(22)	--	129		
1,2,4-Trichlorobenzene		--	--	--	--	--	--	--	--	--	129	(22)	160	--	(22)	--	129		
1,2-Dichlorobenzene	1,2-Dichloroethene Propylene dichloride	--	--	--	--	--	--	--	--	--	129	(22)	1,970	--	(24)	--	129		
1,2-Dichloroethane		--	--	--	--	--	--	--	--	--	113,000	22,600	--	--	--	22,600			
1,2-Dichloroethene (total)		--	--	--	--	--	--	--	--	--	224,000	44,800	(27)	--	--	44,800			
1,2-Dichloropropane		--	--	--	--	--	--	--	--	--	3,040	(28)	10,300	--	(28)	--	3,040		
1,3-Dichlorobenzene		--	--	--	--	--	--	--	--	--	129	(22)	1,970	--	(24)	--	129		
1,3-Dichloropropene (total)		--	--	--	--	--	--	--	--	--	--	790	158	(29)	--	--	158		
1,4-Dichlorobenzene		--	--	--	--	--	--	--	--	--	129	(22)	1,970	--	(24)	--	129		
2,4-Dinitrophenol		--	--	--	--	--	--	--	--	--	4,850	970	(88)	--	--	970			
2,4-Dinitrotoluene		--	--	--	--	--	--	--	--	--	590	118	(53)	370	(53, 82)	--	118		
2,6-Dinitrotoluene		--	--	--	--	--	--	--	--	--	590	118	(53)	370	(53, 82)	--	118		
2-Chloronaphthalene	Nitrophenol 2,4-DDD; DDD 2,4-DDE 4,4'-DDT	--	--	--	--	--	--	--	--	--	--	7.5	1.5	(48)	--	--	1.5		
2-Nitrophenol		--	--	--	--	--	--	--	--	--	4,850	970	(88)	--	--	970			
4,4'-DDD		--	--	--	--	--	--	--	--	--	3.6	0.72	--	--	--	.72			
4,4'-DDE		--	--	--	--	--	--	--	--	--	14	2.8	--	--	--	2.8			
4,4'-DDT		--	--	0.001	(114)	0.13	--	--	0.001	G,aa,ii	0.13	--	G,ii	--	--	--	0.001		
4,6-Dinitro-2-methylphenol	4,6-Dinitro-o-cresol Dinitrotoluenes; 4-Methyl-3,5-dinitroaniline	--	--	--	--	--	--	--	--	--	--	4,850	970	(88)	--	--	970		
4-Amino-2,6-dinitrotoluene		--	--	--	--	--	--	--	--	--	590	118	--	370	(82)	--	118		
4-Nitrophenol		--	--	--	--	--	--	--	--	--	4,850	970	(88)	--	--	970			
Acenaphthene		--	--	--	--	--	--	--	--	--	710	--	970	--	500	(38)	710		
Acenaphthylene		--	--	--	--	--	--	--	--	--	--	--	970	--	--	--	--		
Aldrin	Chlordane	--	--	--	--	--	--	--	--	--	1.3	0.26	G	--	--	--	0.26		
Alpha-chlordane		--	--	0.004	(114)	--	--	0.004	G,aa,o	0.09	--	G,o	--	--	--	--	0.004		
Anthracene		--	--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	60		
Aroclor-1016		--	--	0.03	rr	--	--	0.03	N,aa	--	--	--	10	--	--	--	0.03		
Aroclor-1221		--	--	0.03	rr	--	--	0.03	N,aa	--	--	--	10	--	--	--	0.03		
Aroclor-1232	Polychlorinated biphenyls (PCBs)	--	--	0.03	rr	--	--	0.03	N,aa	--	--	10	--	--	--	--	0.03		
Aroclor-1242		--	--	0.03	rr	--	--	0.03	N,aa	--	--	10	--	--	--	--	0.03		
Aroclor-1248		--	--	0.03	rr	--	--	0.03	N,aa	--	--	10	--	--	--	--	0.03		
Aroclor-1254		--	--	0.03	rr	--	--	0.03	N,aa	--	--	10	--	--	--	--	0.03		
Aroclor-1260		--	--	0.03	rr	--	--	0.03	N,aa	--	--	10	--	--	--	--	0.03		
Arsenic		36	b	36	mm, oo	69	--	mm, oo	--	36	A,D,bb	69	--	A,D,bb	--	--	36		
Atrazine		--	--	--	--	--	--	--	11	r,(68)	310	--	r,(68)	--	--	--	11		
Benzene		--	--	--	--	--	--	--	--	--	--	5,100	--	--	700	(83)	700		
Benzo(a)anthracene		--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	60		
Benzo(a)pyrene		--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	60		
Benzo(b)fluoranthene		--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	60		
Benzo(g,h,i)perylene		--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	60		
Benzo(k)fluoranthene		--	--	--	--	--	--	--	--	--	--	300	60	(52)	--	--	60		
Bromochloromethane		--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	6,400
Bromodichloromethane		--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	6,400
Bromoform	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	6,400	
Bromomethane	n-Butyl benzyl phthalate	--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	6,400
Butylbenzylphthalate		--	--	--	--	--	--	--	--	--	--	2,944	588.8	(45)	3.4	(38, 45)	--	588.8	
Cadmium		9.3	b	9.3	(1, 142)	42	--	(1, 142)	--	8.8	D,bb,gg	40	--	D,bb,gg	--	--	--	8.8	
Carbon tetrachloride		--	--	--	--	--	--	--	--	--	--	--	6,400	(20)	50,000	--	--	6,400	
Chlordane		--	--	0.004	(114)	--	--	--	0.09	0.009	--	0.004	G,aa	0.09	0.009	G	--	0.004	
Chlorobenzene	Monochlorobenzene	--	--	--	--	--	--	--	--	--	--	129	(22)	160	--	(22)	--	129	
Chloroform		--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	6,400
Chloromethane		--	--	--	--	--	--	--	--	--	--	6,400	(20)	12,000	--	(20)	11,500	(20, 82)	6,400
Chromium (total)		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	400	s	400
Chromium VI		50 (VI)	b	50 (VI)	--	1,100 (VI)	--	--	50 (VI)	D,bb	1,100 (VI)	--	D,bb	--	--	--	--	50	

TABLE I-1: SURFACE WATER QUALITY CRITERIA FOR THE SAN FRANCISCO BAY (CONTINUED)
Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Analyte	Pseudonym	San Francisco Bay Basin Plan ^a (µg/L)	California Toxics Rule Criteria for Enclosed Bays and Estuaries ^e (µg/L)			National Recommended Water Quality Criteria ^k (µg/L)		National Ambient Water Quality Criteria (AWQC) for Protection of Saltwater Aquatic Life ⁱ (µg/L)					Other Criteria (footnotes indicate source) (µg/L)	Selected Water Quality Criteria (µg/L)
						Saltwater Aquatic Life		Lowest Observed Effect Level (LOEL)						
			Chronic ^g	Acute ^g		Instantaneous Maximum	Chronic ^g	Acute ^g		Chronic ^h	Acute ⁱ		Other ^j	
			Concentration Footnotes	Concentration Footnotes	20% of Concentration ^f Footnotes	Concentration Footnotes	Concentration Footnotes	20% of Concentration ^f Footnotes	Concentration Footnotes	Concentration Footnotes	20% of Concentration ^f Footnotes	Concentration Footnotes		
Chrysene		--	--	--	--	--	--	--	300	60 (52)	--	--	60	
Cis-1,2-dichloroethene	Cis-1,2-dichloroethylene	--	--	--	--	--	--	224,000	44,800 (27)	--	--	--	44,800	
Copper		--	3.1 nn, oo	4.8 -- oo	--	--	3.1 D, cc, ff	4.8 -- D, cc, ff	--	--	--	--	3.1	
Cyanide		--	1 pp	1 -- pp	--	--	1 Q, bb	1 -- Q, bb	--	--	--	--	1	
Dibenz(a,h)anthracene	1,2,5,6-Dibenzanthracene	--	--	--	--	--	--	--	300	60 (52)	--	--	60	
Dibromochloromethane		--	--	--	--	--	--	--	12,000	-- (20)	11,500 (20, 82)	--	6,400	
Dieldrin		--	0.0019 (114), II	--	--	0.71 -- II	0.0019 G, aa	0.71 0.142 G	6,400 (20)	--	--	--	0.142	
Diethylphthalate		--	--	--	--	--	--	--	2,944	588.8 (45)	3.4 (38, 45)	--	588.8	
Dimethylphthalate		--	--	--	--	--	--	--	2,944	-- (45)	3.4 (38, 45)	--	3.4	
Di-n-butylphthalate	Dibutyl phthalate	--	--	--	--	--	--	--	2,944	588.8 (45)	3.4 (38, 45)	--	588.8	
Di-n-octylphthalate	Bis-n-octyl phthalate	--	--	--	--	--	--	--	2,944	588.8 (45)	3.4 (38, 45)	--	588.8	
Endosulfan I	Endosulfan (alpha)	--	0.0087 II	--	--	0.034 -- (115), II	0.0087 G, Y, o	0.034 -- G, Y, o	--	--	--	--	0.0087	
Endosulfan II	Endosulfan (beta)	--	0.0087 II	--	--	0.034 -- (115), II	0.0087 G, Y, o	0.034 -- G, Y, o	--	--	--	--	0.0087	
Endrin		--	0.0023 (114), II	--	--	0.037 -- II	0.0023 G, aa	0.037 -- G	--	--	--	--	0.0023	
Ethylbenzene		--	--	--	--	--	--	--	--	--	--	--	86	
Fluoranthene		--	--	--	--	--	--	--	16	--	--	--	16	
Fluorene		--	--	--	--	--	--	--	300	60 (52)	--	--	60	
Gamma-BHC (lindane)	Gamma-Benzene hexachloride	--	--	--	--	0.16 -- II	--	0.16 0.032 G	--	--	--	--	0.032	
Gamma-chlordane	Chlordane	--	0.004 (114)	--	--	0.09 --	0.004 G, aa, o	0.09 -- G, o	--	--	--	--	0.004	
Heptachlor		--	0.0036 (114)	II	--	0.053 -- II	0.0036 G, aa	0.053 -- G	--	--	--	--	0.0036	
Heptachlor epoxide		--	0.0036 (114)	II	--	0.053 -- II	0.0036 G, V, aa	0.053 -- G, V	--	--	--	--	0.0036	
Hexachlorobenzene		--	--	--	--	--	--	--	129 (22)	160	-- (22)	--	129	
Hexachlorobutadiene		--	--	--	--	--	--	--	32	6.4 --	--	--	6.4	
Hexachlorocyclopentadiene		--	--	--	--	--	--	--	7.0	1.4 --	--	--	1.4	
Hexachloroethane		--	--	--	--	--	--	--	940	188 --	--	--	188	
Indeno(1,2,3-cd)pyrene	Ideno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	300	60 (52)	--	--	60	
Isophorone		--	--	--	--	--	--	--	12,900	2,580 --	--	--	2,580	
Lead		8.1 b	8.1 (1, 142), m	210 -- (1, 142), m	--	--	8.1 D, bb	210 -- D, bb	--	--	--	--	5.6	
Mercury	Mercury, inorganic	0.025 b	--	--	--	--	0.94 D, ee, hh	1.8 -- D, ee, hh	--	--	--	--	0.025	
Methoxychlor		--	--	--	--	--	--	--	--	--	0.003 (51), f	--	0.003	
Methyl-tert-butyl-ether	Methyl t-butyl ether (MTBE)	--	--	--	--	--	--	--	--	--	8,000 p	--	8,000	
Methylene chloride	Dichloromethane	--	--	--	--	--	--	--	6,400 (20)	12,000	-- (20)	11,500 (20, 82)	6,400	
Mirex		--	--	--	--	--	0.001 F	--	--	--	--	--	0.001	
Naphthalene		--	--	--	--	--	--	--	2,350	470 --	--	--	470	
Nickel		8.2 b	8.2 (2, 142), oo	74 -- (1, 142), oo	--	--	8.2 D, bb	74 -- D, bb	--	--	--	--	8.2	
Nitrobenzene		--	--	--	--	--	--	--	6,680	1,336 --	--	--	1,336	
N-Nitroso-di-n-propylamine	N-Nitrosodi-n-propylamine	--	--	--	--	--	--	--	3,300,000	660,000 (56)	--	--	660,000	
N-nitrosodiphenylamine		--	--	--	--	--	--	--	3,300,000	660,000 (56)	--	--	660,000	
Pentachlorophenol		--	7.9 --	13 --	--	--	7.9 bb	13 -- bb	--	--	--	--	7.9	
Phenanthrene		--	--	--	--	--	--	--	300	60 (52)	--	--	60	
Phenol		--	--	--	--	--	--	--	5,800	1,160 --	--	--	1,160	
Pyrene		--	--	--	--	--	--	--	300	60 (52)	--	--	60	
Selenium		5.0 b	71 (1, 142)	290 -- (1, 142)	--	--	71 D, bb, dd	290 -- D, bb, dd	--	--	--	--	5	
Silver		1.9 c	--	1.9 0.38 (1, 142)	--	--	--	1.9 0.38 D, G	--	--	--	--	0.38	
Sulfide	Sulfide-Hydrogen Sulfide	--	--	--	--	--	--	--	--	--	0.2 (51), f	--	0.2	
Tetrachloroethene	Tetrachloroethylene (PCE)	--	--	--	--	--	--	--	450	10,200	--	--	450	
Thallium		--	--	--	--	--	--	--	2,130	426 --	--	--	426	
Toluene		--	--	--	--	--	--	--	5,000	6,300	--	--	5,000	
Toxaphene		--	0.002 --	0.21 --	--	--	0.002 aa	0.21 --	--	--	--	--	0.002	
TPH-Diesel	Diesel range organics; Diesel Fuel; Diesel	--	--	--	--	--	--	--	--	--	1,400 q	--	1,400	
TPH-Gasoline	Gasoline range organics; Gasoline	--	--	--	--	--	--	--	--	--	1,400 q	--	1,400	
TPH-Motor Oil	Motor oil; motor oil range organics	--	--	--	--	--	--	--	--	--	1,400 q	--	1,400	
trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene	--	--	--	--	--	--	--	224,000	44,800 (27)	--	--	44,800	
Trichloroethene	Trichloroethylene (TCE)	--	--	--	--	--	--	--	2,000	400 --	--	--	400	
Zinc		81 b	81 mm, oo	90 -- oo	--	--	81 D, bb	90 -- D, bb	--	--	--	--	81	

TABLE I-1: SURFACE WATER QUALITY CRITERIA FOR THE SAN FRANCISCO BAY (CONTINUED)
Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Notes: Values shaded are selected as screening criteria.
Footnotes and references are detailed below.

- No criterion available
- ug/L Microgram per liter
- BHC Benzene Hexachloride (Lindane)
- DDD Dichlorodiphenyldichloroethane
- DDE 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene
- DDT 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane
- TPH Total petroleum hydrocarbons

Footnotes:

- a California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Area Region (Water Board). "Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin." Table 3-3 Marine Water Quality Objectives for Toxic Pollutants for Surface Waters. Available online at <http://www.waterboards.ca.gov/sanfranciscobay/basinplan.htm>
- b From Water Board "Basin Plan" 4-Day Average (Chronic)
- c From Water Board "Basin Plan" 24-Hour and 1-Hour Average (Acute)
- d From Water Board "Basin Plan" Instantaneous Maximum
- e From "Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (CTR) (EPA 2000) and "Water Quality Control Plan, San Francisco Bay Basin Region" (Water Board 1995). The most appropriate criteria were used.
- f Criterion made more suitably protective by means of standard convention of lowering acute values by 80 percent and instantaneous values by 90 percent to make them more appropriate for use under chronic exposure scenarios.
- g An acute criterion (EPA identified as Criteria Maximum Concentration [CMC]) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The chronic concentration (EPA identified as Criterion Continuous Concentration [CCC]) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. The CMC and CCC are just two of the six parts of an aquatic life criterion; the other four parts are the acute averaging period, chronic averaging period, acute frequency of elevated level allowed, and chronic frequency of elevated level allowed. Because Clean Water Act 304(a) aquatic life criteria are national guidance, they are intended to be protective of the vast majority of the aquatic communities in the United States (EPA 2002a).
- h EPA National "AWQC Lowest Observed Effect Level (Chronic)" (Water Board 2007)
- i EPA National "AWQC Lowest Observed Effect Level (Acute)" (Water Board 2007)
- j EPA National "AWQC Lowest Observed Effect Level (Other)" (Water Board 2007)
- k From "National Recommended Water Quality Criteria: 2002" (EPA 2002a) and "Revision of National Recommended Water Quality Criteria." (EPA 2002b), unless otherwise noted.
- l From "Final Technical Memorandum Estimation of Ambient Concentrations of Metals in Groundwater" (Tetra Tech 2001)
- m In instances where criteria from "Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (EPA 2000) refer to the "Water Quality Control Plan, San Francisco Bay Basin Region" (Water Board 1995), Water Board 1995 criteria were used. The Water Board 1995 criteria are distinguished by an "m" in the footnote column.
- o Detailed application of this toxicity criterion may require the review or summation of analyte isomer, congener, or speciation results, as applicable. Please see applicable regulatory agency source document for additional detail.
- p Water Board 1998
- q Tetra Tech EM Inc. 1999
- r Water Board 2007
- s Value derived in Appendix I; based on EPA "Ambient Water Quality Criteria for Chromium" EPA 440/5-80-035 with adjustment for chronic from acute criterion

The following lettered footnotes are derived from EPA "National Recommended Water Quality Criteria: 2002" (EPA 2002a), Table 1 - Priority Toxic Pollutants:

- A This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic, which might imply that arsenic (III) and arsenic (V) are equally toxic to aquatic life and that their toxicities are additive. In the arsenic criteria document (EAP 440/5-84-033, January 1985), Species Mean Acute Values (SMAVs) are given for both arsenic (III) and arsenic (V) for five species, and the ratios of the SMAVs for each species range from 0.6 to 1.7. Chronic values are available for both arsenic (III) and arsenic (V) for one species; for the fathead minnow, the chronic value for arsenic (V) is 0.29 times the chronic value for arsenic (III). No data are known to be available on whether the toxicities of the forms of arsenic to aquatic organisms are additive.
- D Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. The recommended water quality criteria value was calculated by using the previous 304(a) aquatic life criteria expressed in terms of total recoverable metal, and multiplying it by a conversion factor (CF). The term "Conversion Factor" (CF) represents the recommended conversion factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column. (Conversion Factors for saltwater CCCs are currently unavailable. Conversion factors derived for saltwater CMCs have been used for both saltwater CMCs and CCCs). See "Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria," October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington DC 20460; and 40CFR 131.36(b)(1). Conversion Factors applied in the table can be found in Appendix A to the Preamble - Conversion Factors for Dissolved Metals.
- F The deviation of this value is presented in the Red Book (EPA 440/9-76-023, July 1976).
- G The criterion is based on Clean Water Act 304(a) aquatic life criterion issued in 1980 and was issued in one of the following documents: Aldrin/Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), Dichlorodiphenyltrichloroethane (DDT) (EPA 440/5-80-38), Endosulfan (EPA 440/5-80-046), Endrin (EPA 440/5-80-047), Heptachlor (EPA 440/5-80-052), Hexachlorocyclohexane (EPA 440/5-80-054), Silver (EPA 440/5-80-071). The minimum data requirements and derivation procedures were different in the 1980 guidelines than in the 1985 guidelines. For example, a "CMC" derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 guidelines.
- N This criterion applies to total polychlorinated biphenyls (the sum of all congener or all isomer or homolog or Aroclor analyses.)
- Q This recommended water quality criterion is expressed as mg free cyanide (as CN)/L.
- V This value was derived from data for heptachlor, and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.
- Y This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
- aa This criterion is based on a Clean Water Act 304(a) aquatic life criterion issued in 1980 or 1986, and was issued in one of the following documents : Aldrin/Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), DDT (EPA 440/5-80-038), Endrin (EPA 440/5-80-047), Heptachlor (EPA 440/5-80-052), Polychlorinated biphenyls (EPA 440/5-80-068), Toxaphene (EPA 440/5-86-006). This CCC is currently based on the Final Residue Value (FRV) procedure. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60 FR 15393-15399, March 23, 1995), the EPA no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria. Therefore, the EPA anticipates that future revisions of this CCC will not be based on FRV procedure.
- bb This water quality criterion is based on a 304(a) aquatic life criterion that was derived using the 1985 Guidelines (Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, PB85-227046, January 1985) and was issued in one of the following criteria documents: Arsenic (EPA 440/5-84-033), Cadmium (EPA 882-R-01-001), Chromium (EPA 440/5-84-029), Copper (EPA 440/5-84-031), Cyanide (EPA 440/5-84-028), Lead (EPA 440/5-84-027), Nickel (EPA 440/5-86-004), Pentachlorophenol (EPA 440/5-86-009), Toxaphene (EPA 440/5-86-006), Zinc (EPA 440/5-87-003).
- cc When the concentration of dissolved organic carbon is elevated, copper is substantially less toxic, and use of Water-Effect Ratios might be appropriate.
- dd The selenium criteria document (EPA 440/5-87-006, September 1987) provides that if selenium is as toxic to saltwater fishes in the field as it is to freshwater fish in the field, the status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 milligrams per liter (mg/L) in salt water because the saltwater CCC does not take into account uptake via the food chain.
- ee This recommended water quality criterion was derived on page 43 of the mercury document (EPA 440/5-84-026, January 1985). The saltwater CCC of 0.025 µg/L given on page 23 of the criteria document is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60 FR 15393-15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised Clean Water Act 304(a) aquatic life criteria.
- ff This recommended water quality criterion was derived in Ambient Water Quality Criteria Saltwater Copper Addendum (draft, April 14, 1995) and was promulgated in the interim final National Toxics Rule (60 FR 22228-222237, May 4, 1995).
- gg EPA is working on this criterion, and so this recommended water quality criterion may change substantially in the near future.
- hh This recommended water quality criterion was derived from data for inorganic mercury (II), but is applied here to total mercury. If a substantial portion of the mercury in the water column is methylmercury, this criterion will probably be under protective. In addition, even though inorganic mercury is converted to methylmercury, and methylmercury bioaccumulates to a great extent, this criterion does not account for uptake via the food chain because sufficient data were not available when the criterion was derived.
- ii This criterion applies to DDT and its metabolites (that is, the total concentration of DDT and its metabolites should not exceed this value.)

TABLE I-1: SURFACE WATER QUALITY CRITERIA FOR THE SAN FRANCISCO BAY (CONTINUED)
Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

- The following lettered footnotes are derived from EPA "Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California" (EPA 2000).
- ll This criterion is based on Clean Water Act 304(a) aquatic life criterion issued in 1980, and was issued in one of the following documents: Aldrin/ Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), DDT (EPA 440/5-80-038), Endosulfan (EPA 440/5-80-046), Endrin (EPA 440/5-80-047), Heptochlor (440/5-80-025), Hexachlorocyclohexane (EPA 440/5/80/054), Silver (EPA 440/5-80-071) (originally footnote g in CTR).
 - mm Criteria for these metals are expressed as a function of the water-effect ratio (WER) (originally footnote I in the CTR).
 - nn No criterion for protection of human health from consumption of aquatic organisms (excluding water) was presented in the 1980 criteria document or in the 1986 Quality Criteria for Water. Nevertheless, sufficient information was presented in the 1980 document to allow a calculation of a criterion, even though the results of the calculations were not shown in the document.
 - oo These freshwater and saltwater criteria for metals are expressed in terms of dissolved fraction of the metal in the water column. Criterion values were calculated by using EPA's Clean Water Act 304(a) guidance values (described in the total recoverable fraction) and then applying the conversion factors in 131.36(b)(i) and (2).
 - pp These criteria were promulgated for specific waters in California in the National Toxics Rule (NTR). The specific waters to which the NTR criteria apply include Waters of the State defined as bays or estuaries, including the San Francisco Bay upstream to and including Suisun Bay and the Sacramento-San Joaquin Delta. This section does not apply instead of the NTR for these criteria.
 - rr PCBs are a class of chemicals that include Aroclors 1242,1254,1221,1232,1248,1260, and 1016. The aquatic life criteria apply to the sum of this set of seven Aroclors.

The following numbered footnotes are derived from "A Compilation of Water Quality Goals" (Water Board 2007). These footnotes directly correlate with the source document.

- 1 Expressed as dissolved
- 2 Expressed as total recoverable
- 6 Pentavalent arsenic [As(V)] effects on plants.
- 20 For halomethanes
- 22 For chlorinated benzenes
- 23 Toxicity to a fish species exposed for 7.5 days
- 24 For dichlorobenzenes
- 27 For dichloroethylenes
- 28 For dichloropropanes
- 29 For dichloropropenes
- 38 Toxicity to algae occurs
- 45 For phthalate esters
- 48 For chlorinated naphthalenes
- 51 From U.S. Environmental Protection Agency. *Quality Criteria for Water* (1976) "The Red Book."
- 52 For polycyclic aromatic hydrocarbons
- 53 For dinitrotoluenes
- 56 For nitrosamines
- 68 Draft/tentative/provisional; applies only to second value if more than one value is listed.
- 82 A decrease in the number of algal cells occurs.
- 83 Adverse effects on a fish species exposed for 168 days.
- 88 For nitrophenols
- 95 For the pentavalent form
- 114 Developed as 24-hour average using 1980 EPA guidelines, but applied as 4-day average in the National Toxics Rule or Proposed California Toxics Rule.
- 115 Criterion most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
- 116 Applies separately to Aroclors 1242, 1254, 1221, 1232, 1248, 1260, and 1016; based on carcinogenicity at 1-in-a-million risk level.
- 142 Criteria do not apply to waters subject to water quality objectives in Tables III-2A and III-2B of the San Francisco Bay Regional Water Quality Control Board's 1986 Basin Plan.
- 143 These criteria were promulgated for specific California waters in the National Toxics Rule.
- 144 The ambient level was set at or below the minimum reported detection limit.
- 145 The ambient concentration represents the 95th percentile of the distribution. Additionally, the 95th percentile of the distribution was calculated using distribution-dependent formulae. For normal and lognormal distributions, the 95th percentile calculation used the parameters of the best-fitted regression line drawn through the detected values on the probability plot. For nonparametric distribution, the analytical formula was used (Gilbert 1987).

References:

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TABLE I-2: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - METALS

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of HGALs					Comparison of Surface Water Criteria				
				HGAL Screening Level (µg/L)	Number of Detects > HGAL	Percent of Detects > HGAL	Number of Nondetects with Limits > HGAL	Percent of Nondetects with Limits > HGAL	Surface Water Criterion ¹ (µg/L)	Number of Detects > Surface Water Criterion	Percent of Detects > Surface Water Criterion	Number of Nondetects with Limits > Surface Water Criterion	Percent of Nondetects with Limits > Surface Water Criterion
ALUMINUM	414	34	8.21	NA	NA	NA	NA	NA	NA	NA	0	NA	0
ANTIMONY	415	69	16.63	43.26	4	5.80	34	9.83	NA	NA	0	NA	0
ARSENIC	425	135	31.76	27.34	8	5.93	6	2.07	36	5	3.70	5	1.72
BARIUM	416	396	95.19	504.20	35	8.84	0	0	NA	NA	0	NA	0
BERYLLIUM	421	36	8.55	1.40	7	19.44	62	16.10	NA	NA	0	NA	0
CADMIUM	416	46	11.06	5.08	7	15.22	14	3.78	8.8	3	6.52	13	3.51
CALCIUM	403	400	99.26	NA	NA	NA	NA	NA	NA	NA	0	NA	0
CHROMIUM (total)	462	132	28.57	15.66	27	20.45	16	4.85	400	5	3.79	0	0
CHROMIUM VI	354	24	6.78	NA	NA	NA	NA	NA	50	10	41.67	0	0
COBALT	416	178	42.79	20.80	10	5.62	26	10.92	NA	NA	0	NA	0
COPPER	437	69	15.79	28.04	7	10.14	14	3.80	3.1	46	66.67	139	37.77
IRON	409	152	37.16	2.380	10	6.58	0	0	NA	NA	0	NA	0
LEAD	426	25	5.87	14.44	7	28.00	17	4.24	8.1	8	32.00	58	14.46
MAGNESIUM	408	406	99.51	1,440,000	1	0.25	0	0	NA	NA	0	NA	0
MANGANESE	436	388	88.99	8.140	7	1.80	0	0	NA	NA	0	NA	0
MERCURY	436	49	11.24	0.60	13	26.53	0	0	0.025	49	100	381	98.45
MOLYBDENUM	385	119	30.91	61.90	2	1.68	0	0	NA	NA	0	NA	0
NICKEL	415	280	67.47	96.48	19	6.79	7	5.19	8.2	225	80.36	77	57.04
POTASSIUM	408	395	96.81	448,000	16	4.05	0	0	NA	NA	0	NA	0
SELENIUM	377	46	12.20	14.50	6	13.04	50	15.11	71	1	2.17	5	1.51
SILVER	416	22	5.29	7.43	5	22.73	56	14.21	0.38	22	100	394	100
SODIUM	412	409	99.27	9,242,000	5	1.22	0	0	NA	NA	0	NA	0
THALLIUM	388	81	20.88	12.97	12	14.81	71	23.13	426	0	0	0	0
VANADIUM	411	181	44.04	26.62	5	2.76	34	14.78	NA	NA	0	NA	0
ZINC	437	74	16.93	75.68	15	20.27	22	6.06	81	13	17.57	21	5.79

Notes: **Bold** chemicals indicate chemicals of potential concern.

¹ The published sources are provided in the footnotes to Table I-1.

µg/L Microgram per liter

HGAL Hunters Point groundwater ambient level Source: PRC Environmental Management, Inc. 1996. "Estimation of Hunters Point Shipyard Groundwater Ambient Levels Technical Memorandum, Hunters Point Shipyard, San Francisco, California." September 16.

NA Not available

TABLE I-3: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - VOLATILE ORGANIC COMPOUNDS

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
1,1,1,2-TETRACHLOROETHANE	25	0	0	NA	NA	0	NA	0
1,1,1-TRICHLOROETHANE	474	0	0	6,240	ND	0	0	0
1,1,2,2-TETRACHLOROETHANE	474	1	0.21	1,804	0	0	0	0
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	251	11	4.38	NA	NA	0	NA	0
1,1,2-TRICHLOROETHANE	474	0	0	NA	NA	0	NA	0
1,1-DICHLOROETHANE	474	11	2.32	NA	NA	0	NA	0
1,1-DICHLOROETHENE	474	4	0.84	44,800	0	0	0	0
1,2,3-TRICHLOROBENZENE	74	0	0	NA	NA	0	NA	0
1,2,3-TRICHLOROPROPANE	25	0	0	NA	NA	0	NA	0
1,2,4-TRICHLOROBENZENE	436	1	0.23	129	0	0	0	0
1,2-DIBROMO-3-CHLOROPROPANE	213	0	0	NA	NA	0	NA	0
1,2-DIBROMOETHANE	223	0	0	NA	NA	0	NA	0
1,2-DICHLOROBENZENE	437	1	0.23	129	0	0	0	0
1,2-DICHLOROETHANE	489	4	0.82	22,600	0	0	0	0
1,2-DICHLOROETHENE (TOTAL)	300	21	7	44,800	0	0	0	0
1,2-DICHLOROPROPANE	474	0	0	3,040	ND	0	0	0
1,3-DICHLOROBENZENE	436	2	0.46	129	0	0	0	0
1,4-DICHLOROBENZENE	436	3	0.69	129	0	0	0	0
1-BUTANOL	5	0	0	NA	NA	0	NA	0
1-PENTANOL	5	0	0	NA	NA	0	NA	0
1-PROPANOL	5	0	0	NA	NA	0	NA	0
2-BUTANOL	5	0	0	NA	NA	0	NA	0
2-BUTANONE	436	0	0	NA	NA	0	NA	0
2-CHLOROETHYL VINYL ETHER	24	0	0	NA	NA	0	NA	0
2-HEXANONE	404	1	0.25	NA	NA	0	NA	0
2-METHYL-1-BUTANOL	5	0	0	NA	NA	0	NA	0
2-METHYL-2-BUTANOL	5	0	0	NA	NA	0	NA	0
2-METHYL-2-PROPANOL	5	0	0	NA	NA	0	NA	0
3-METHYL-1-BUTANOL	5	0	0	NA	NA	0	NA	0
3-PENTANOL	5	0	0	NA	NA	0	NA	0
4-METHYL-2-PENTANONE	419	0	0	NA	NA	0	NA	0
ACETONE	419	1	0.24	NA	NA	0	NA	0

TABLE I-3: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - VOLATILE ORGANIC COMPOUNDS (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
BENZENE	502	5	1.00	700	0	0	0	0
BROMOBENZENE	25	0	0	NA	NA	0	NA	0
BROMOCHLOROMETHANE	88	0	0	6,400	ND	0	0	0
BROMODICHLOROMETHANE	474	0	0	6,400	ND	0	0	0
BROMOFORM	474	0	0	6,400	ND	0	0	0
BROMOMETHANE	474	2	0.42	6,400	0	0	0	0
CARBON DISULFIDE	439	23	5.24	NA	NA	0	NA	0
CARBON TETRACHLORIDE	489	0	0	6,400	ND	0	0	0
CHLOROBENZENE	474	13	2.74	129	0	0	0	0
CHLOROETHANE	474	1	0.21	NA	NA	0	NA	0
CHLOROFORM	489	18	3.68	6,400	0	0	0	0
CHLOROMETHANE	474	0	0	6,400	ND	0	0	0
CIS-1,2-DICHLOROETHENE	266	67	25.19	44,800	0	0	0	0
CIS-1,3-DICHLOROPROPENE	474	0	0	NA	NA	0	NA	0
CYCLOHEXANE	208	0	0	NA	NA	0	NA	0
DIBROMOCHLOROMETHANE	474	0	0	6,400	ND	0	0	0
DIBROMOMETHANE	25	0	0	NA	NA	0	NA	0
DICHLORODIFLUOROMETHANE	247	9	3.64	NA	NA	0	NA	0
ETHANOL	5	0	0	NA	NA	0	NA	0
ETHYLBENZENE	502	2	0.40	86	0	0	0	0
ISOBUTYL ALCOHOL	5	0	0	NA	NA	0	NA	0
ISOPROPYL ALCOHOL	5	0	0	NA	NA	0	NA	0
ISOPROPYLBENZENE	215	0	0	NA	NA	0	NA	0
M,P-XYLENES	18	5	27.78	NA	NA	0	NA	0
METHANOL	5	0	0	NA	NA	0	NA	0
METHYL ACETATE	193	0	0	NA	NA	0	NA	0
METHYLCYCLOHEXANE	208	0	0	NA	NA	0	NA	0
METHYLENE CHLORIDE	474	1	0.21	6,400	0	0	0	0
O-XYLENE	18	0	0	NA	NA	0	NA	0
STYRENE	438	0	0	NA	NA	0	NA	0
TERT-BUTYL METHYL ETHER	300	7	2.33	NA	NA	0	NA	0

TABLE I-3: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - VOLATILE ORGANIC COMPOUNDS (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
TETRACHLOROETHENE	489	2	0.41	450	0	0	0	0
TOLUENE	502	15	2.99	5,000	0	0	0	0
TRANS-1,2-DICHLOROETHENE	266	15	5.64	44,800	0	0	0	0
TRANS-1,3-DICHLOROPROPENE	474	0	0	NA	NA	0	NA	0
TRICHLOROETHENE	489	63	12.88	400	2	3.17	0	0
TRICHLOROFLUOROMETHANE	247	11	4.45	NA	NA	0	NA	0
VINYL ACETATE	54	1	1.85	NA	NA	0	NA	0
VINYL CHLORIDE	489	8	1.64	NA	NA	0	NA	0
XYLENE (TOTAL)	490	3	0.61	NA	NA	0	NA	0

Notes: **Bold** chemicals indicate chemicals of potential concern.

¹ The published sources are provided in the footnotes to Table I-1.

µg/L Microgram per liter

NA Not available

ND Not detected

TABLE I-4: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - SEMIVOLATILE ORGANIC COMPOUNDS

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
2,2'-OXYBIS(1-CHLOROPROPANE)	252	0	0	NA	NA	0	NA	0
2,4,5-TRICHLOROPHENOL	236	0	0	NA	NA	0	NA	0
2,4,6-TRICHLOROPHENOL	237	1	0.42	NA	NA	0	NA	0
2,4-DICHLOROPHENOL	237	0	0	NA	NA	0	NA	0
2,4-DIMETHYLPHENOL	237	0	0	NA	NA	0	NA	0
2,4-DINITROPHENOL	233	0	0	46	ND	0	51	21.89
2,4-DINITROTOLUENE	251	0	0	118	ND	0	0	0
2,6-DINITROTOLUENE	251	3	1.20	118	0	0	0	0
2-CHLORONAPHTHALENE	254	0	0	1.5	ND	0	254	100
2-CHLOROPHENOL	238	0	0	NA	NA	0	NA	0
2-METHYLNAPHTHALENE	274	3	1.09	NA	NA	0	NA	0
2-METHYLPHENOL	237	0	0	NA	NA	0	NA	0
2-NITROANILINE	236	0	0	NA	NA	0	NA	0
2-NITROPHENOL	253	0	0	970	ND	0	0	0
3,3'-DICHLOROBENZIDINE	252	0	0	NA	NA	0	NA	0
3-NITROANILINE	250	0	0	NA	NA	0	NA	0
4,6-DINITRO-2-METHYLPHENOL	236	0	0	970	ND	0	0	0
4-BROMOPHENYL-PHENYLETHER	252	0	0	NA	NA	0	NA	0
4-CHLORO-3-METHYLPHENOL	237	0	0	NA	NA	0	NA	0
4-CHLOROANILINE	252	0	0	NA	NA	0	NA	0
4-CHLOROPHENYL-PHENYLETHER	251	0	0	NA	NA	0	NA	0
4-METHYLPHENOL	237	0	0	NA	NA	0	NA	0
4-NITROANILINE	251	0	0	NA	NA	0	NA	0
4-NITROPHENOL	237	0	0	970	ND	0	0	0
ACENAPHTHENE	276	3	1.09	710	0	0	0	0
ACENAPHTHYLENE	276	0	0	60	ND	0	1	0.36
ACETOPHENONE	13	3	23.08	NA	NA	0	NA	0
ANTHRACENE	277	0	0	60	ND	0	1	0.36
ATRAZINE	13	0	0	11	ND	0	0	0

TABLE I-4: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - SEMIVOLATILE ORGANIC COMPOUNDS (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
BENZALDEHYDE	13	0	0	NA	NA	0	NA	0
BENZO(A)ANTHRACENE	289	0	0	60	ND	0	1	0.35
BENZO(A)PYRENE	287	0	0	60	ND	0	0	0
BENZO(B)FLUORANTHENE	287	0	0	60	ND	0	0	0
BENZO(G,H,I)PERYLENE	275	0	0	60	ND	0	0	0
BENZO(K)FLUORANTHENE	287	0	0	60	ND	0	0	0
BENZOIC ACID	63	0	0	NA	NA	0	NA	0
BENZYL ALCOHOL	62	0	0	NA	NA	0	NA	0
BIPHENYL	13	0	0	NA	NA	0	NA	0
BIS(2-CHLOROETHOXY)METHANE	252	0	0	NA	NA	0	NA	0
BIS(2-CHLOROETHYL)ETHER	252	0	0	NA	NA	0	NA	0
BIS(2-ETHYLHEXYL)PHTHALATE	252	2	0.79	NA	NA	0	NA	0
BUTYLBENZYLPHTHALATE	252	1	0.40	589	0	0	0	0
CAPROLACTAM	12	2	16.67	NA	NA	0	NA	0
CARBAZOLE	189	0	0	NA	NA	0	NA	0
CHRYSENE	289	0	0	60	ND	0	1	0.35
DIBENZ(A,H)ANTHRACENE	287	0	0	60	ND	0	0	0
DIBENZOFURAN	251	0	0	NA	NA	0	NA	0
DIETHYLPHTHALATE	251	1	0.40	589	0	0	0	0
DIMETHYLPHTHALATE	251	0	0	3.4	ND	0	251	100
DI-N-BUTYLPHTHALATE	252	0	0	589	ND	0	0	0
DI-N-OCTYLPHTHALATE	251	1	0.40	589	0	0	0	0
FLUORANTHENE	277	1	0.36	16	0	0	4	1.45
FLUORENE	276	3	1.09	60	0	0	1	0.37
HEXACHLOROBENZENE	252	0	0	129	ND	0	0	0
HEXACHLOROBUTADIENE	252	0	0	6.4	ND	0	252	100
HEXACHLOROCYCLOPENTADIENE	251	0	0	1.4	ND	0	251	100
HEXACHLOROETHANE	252	1	0.40	188	0	0	0	0
INDENO(1,2,3-CD)PYRENE	287	0	0	60	ND	0	0	0

TABLE I-4: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - SEMIVOLATILE ORGANIC COMPOUNDS (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
ISOPHORONE	252	0	0	2,580	ND	0	0	0
NAPHTHALENE	277	2	0.72	470	0	0	0	0
NITROBENZENE	252	0	0	1,336	ND	0	0	0
N-NITROSO-DI-N-PROPYLAMINE	252	0	0	660,000	ND	0	0	0
N-NITROSODIPHENYLAMINE	252	0	0	660,000	ND	0	0	0
PENTACHLOROPHENOL	237	1	0.42	7.9	1	100	236	100
PHENACETIN	17	0	0	NA	NA	0	NA	0
PHENANTHRENE	277	2	0.72	60	0	0	1	0.36
PHENOL	237	0	0	1,160	ND	0	0	0
PYRENE	277	3	1.08	60	0	0	1	0.36

Notes: **Bold** chemicals indicate chemicals of potential concern.

¹ The published sources are provided in the footnotes to Table I-1.

µg/L Microgram per liter

NA Not available

ND Not detected

TABLE I-5: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - PESTICIDES, PCBs, AND CYANIDE

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
4,4'-DDD	223	0	0	0.72	ND	0	0	0
4,4'-DDE	223	0	0	2.8	ND	0	0	0
4,4'-DDT	223	0	0	0.001	ND	0	223	100
ALDRIN	223	1	0.45	0.26	0	0	0	0
ALPHA-BHC	223	1	0.45	NA	NA	0	NA	0
ALPHA-CHLORDANE	234	5	2.14	0.004	2	40	227	99.13
AROCLOR-1016	223	0	0	0.03	ND	0	223	100
AROCLOR-1221	223	0	0	0.03	ND	0	223	100
AROCLOR-1232	223	0	0	0.03	ND	0	223	100
AROCLOR-1242	223	0	0	0.03	ND	0	223	100
AROCLOR-1248	223	0	0	0.03	ND	0	223	100
AROCLOR-1254	223	0	0	0.03	ND	0	223	100
AROCLOR-1260	234	0	0	0.03	ND	0	234	100
BETA-BHC	223	1	0.45	NA	NA	0	NA	0
CYANIDE	13	0	0	1.0	ND	0	4	30.77
DELTA-BHC	223	1	0.45	NA	NA	0	NA	0
DIELDRIN	223	0	0	0.142	ND	0	1	0.45
ENDOSULFAN I	223	0	0	0.0087	ND	0	221	99.10
ENDOSULFAN II	223	0	0	0.0087	ND	0	221	99.10
ENDOSULFAN SULFATE	223	0	0	NA	NA	0	NA	0
ENDRIN	223	0	0	0.0023	ND	0	223	100
ENDRIN ALDEHYDE	181	0	0	NA	NA	0	NA	0
ENDRIN KETONE	223	1	0.45	NA	NA	0	NA	0
GAMMA-BHC (LINDANE)	223	0	0	0.032	ND	0	204	91.48
GAMMA-CHLORDANE	234	2	0.85	0.004	2	100	230	99.14
HEPTACHLOR	223	3	1.35	0.0036	3	100	218	99.09

TABLE I-5: COMPARISON OF GROUNDWATER TO SURFACE WATER QUALITY CRITERIA - PESTICIDES, PCBs, AND CYANIDE (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

Chemical	Number Analyzed	Number Detected	Percent Detected	Comparison of Surface Water Criteria				
				Surface Water Criterion ¹ (µg/L)	Number of Detects Exceeding Surface Water Criterion	Percent of Detects Exceeding Surface Water Criterion	Number of Nondetects with Limits Exceeding Surface Water Criterion	Percent of Nondetects with Limits Exceeding Surface Water Criterion
HEPTACHLOR EPOXIDE	223	1	0.45	0.0036	1	100	216	97.30
METHOXYCHLOR	223	0	0	0.003	ND	0	223	100
TOXAPHENE	223	0	0	0.002	ND	0	223	100

Notes: **Bold** chemicals indicate chemicals of potential concern.

¹ The published sources are provided in the footnotes to Table I-1.

µg/L Microgram per liter

BHC Benzene hexachloride

DDD Dichlorodiphenyldichloroethane

DDE Dichlorodiphenyldichloroethene

DDT Dichlorodiphenyltrichloroethane

NA Not available

ND Not detected

PCB Polychlorinated biphenyl

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Arsenic (Surface Water Screening Criterion = 36 µg/L)				
IR07MW27A	02-Sep-99	25		NO
IR07MW27A	13-Jan-00	51.1		YES
IR07MW27A	16-Oct-00	42.8		YES
IR07MW27A	30-Apr-01	50.4		YES
IR07MW27A	31-May-02	30.7		NO
IR07MW27A	15-Nov-02	38.4		YES
IR07MW27A	06-Mar-03	2	UJ3	NO
IR07MW27A	18-Aug-03	12.8	J	NO
IR07MW27A	24-Mar-04	32		NO
IR07MW27A	03-Jun-04	7.9	U1	NO
IR07MW27A	01-Sep-04	26.1	U1	NO
IR07MW21A1	25-Mar-04	3.3	J	NO
IR07MW21A1	03-Jun-04	10	U	NO
IR07MW21A1	01-Sep-04	38	J	YES
IR07MW21A1	16-Nov-04	6.1		NO
Cadmium (Surface Water Screening Criterion = 9.3 µg/L)				
PA24MW01A	29-Jan-93	13.5		YES
PA24MW01A	18-Aug-94	0.2	U	NO
PA24MW01A	07-Jun-95	0.1	U	NO
IR60MW08A	30-Aug-95	1	U	NO
IR60MW08A	03-Oct-95	7.2		NO
IR60MW08A	06-Nov-95	31.7		YES
IR60MW08A	23-Jul-01	2	U	NO
IR46MW40A2	19-Jul-94	0.2	U	NO
IR46MW40A2	18-Aug-94	16.5		YES
IR46MW40A2	31-May-95	0.24	U1	NO
Chromium (Surface Water Screening Criterion = 400 µg/L)				
IR10MW12A	09-Mar-89	328		NO
IR10MW12A	21-Aug-90	141		NO
IR10MW12A	12-Jul-91	179.5		NO
IR10MW12A	15-Jan-92	65.4		NO
IR10MW12A	09-Nov-93	422		YES
IR10MW12A	17-Feb-94	1,020		YES
IR10MW12A	12-May-94	1,010		YES
IR10MW12A	30-Aug-94	1,140		YES
IR10MW12A	19-Jul-01	287		NO
IR10MW12A	08-Oct-01	110	J4	NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Chromium (Surface Water Screening Criterion = 400 µg/L) (Continued)				
IR07MWP-1	30-Jul-91	1,260		YES
IR07MWP-1	03-Dec-91	8.45		NO
IR07MWP-1	02-Jun-92	10.65		NO
Chromium VI (Surface Water Screening Criterion = 50 µg/L)				
IR10MW12A	13-Mar-02	375		YES
IR10MW12A	30-May-02	160		YES
IR10MW12A	29-Aug-02	60		YES
IR10MW12A	12-Nov-02	10	U	NO
IR10MW12A	12-Mar-03	170		YES
IR10MW12A	22-May-03	360		YES
IR10MW12A	20-Aug-03	320		YES
IR10MW12A	11-Nov-03	220		YES
IR10MW12A	23-Mar-04	550		YES
IR10MW12A	07-Jun-04	170		YES
IR10MW12A	31-Aug-04	20	U	NO
IR10MW12A	16-Nov-04	260		YES
Copper (HGAL = 28.04 µg/L)				
PA50MW01A	18-Mar-02	2.4	U	NO
PA50MW01A	04-Jun-02	362		YES
PA50MW01A	03-Sep-02	0.6	UJ1	NO
PA50MW01A	18-Nov-02	6.2	U1	NO
PA50MW01A	05-Mar-03	5	U	NO
PA50MW01A	21-May-03	0.9	U	NO
PA50MW01A	14-Aug-03	2.4	U	NO
PA50MW01A	29-Mar-04	3.5	U1J3	NO
PA50MW01A	08-Jun-04	25	U	NO
PA50MW01A	02-Sep-04	3.3	U1	NO
PA50MW01A	17-Nov-04	25	UJ9	NO
IR07MW26A	29-Mar-04	130	UJ3	Limit > criterion
IR07MW26A	03-Jun-04	25	U	NO
IR07MW26A	01-Sep-04	43.4	J	YES
IR07MW26A	16-Nov-04	25	U	NO
IR07MW20A2	29-Jul-91	40.6		YES
IR07MW20A2	04-Dec-91	13.5	J7	NO
IR07MW20A2	04-Jun-92	30.25		YES
PA24MW02A	01-Feb-93	0.2	U	NO
PA24MW02A	18-Aug-94	28.7		YES
PA24MW02A	07-Jun-95	0.5	U	NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Copper (HGAL = 28.04 µg/L) (Continued)				
IR26MW47A	12-Mar-02	0.6	U	NO
IR26MW47A	03-Jun-02	248	J23	YES
IR26MW47A	03-Sep-02	0.6	UJ1	NO
IR26MW47A	14-Nov-02	16.8		NO
IR26MW47A	11-Mar-03	3	B	NO
IR26MW47A	22-May-03	0.9	U	NO
IR26MW47A	13-Aug-03	2.4	U	NO
IR26MW47A	06-Nov-03	1.7	U	NO
IR26MW47A	29-Mar-04	130	U	Limit > criterion
IR26MW47A	07-Jun-04	25	U	NO
IR26MW47A	07-Sep-04	11.3	J	NO
IR26MW47A	17-Nov-04	50	UJ9	Limit > criterion
IR10MW13A1	09-Mar-89	2.5	U	NO
IR10MW13A1	22-Aug-90	39.53		YES
IR10MW13A1	11-Jul-91	2.5	U	NO
IR10MW13A1	12-Jul-91	2.5	U	NO
IR10MW13A1	13-Jan-92	1.6	U	NO
Lead (HGAL = 14.44 µg/L)				
PA24MW02A	01-Feb-93	15.2		YES
PA24MW02A	18-Aug-94	1	U	NO
PA24MW02A	07-Jun-95	1.3	U	NO
IR26MW48A	18-Mar-02	2.1	U	NO
IR26MW48A	03-Jun-02	2.4	U	NO
IR26MW48A	04-Sep-02	1.3	U	NO
IR26MW48A	13-Nov-02	0.7	U	NO
IR26MW48A	23-May-03	1.2	U	NO
IR26MW48A	13-Aug-03	14.8	UJ	Limit > criterion
IR26MW48A	05-Nov-03	2.1	U	NO
IR26MW48A	29-Mar-04	50	U	Limit > criterion
IR26MW48A	07-Jun-04	10	U	NO
IR26MW48A	07-Sep-04	71.5		YES
IR07MWS-4	26-Mar-04	10	U	NO
IR07MWS-4	07-Jun-04	10	UJ3	NO
IR07MWS-4	01-Sep-04	15.6		YES
IR07MWS-4	17-Nov-04	5	U	NO
IR07MWS-2	13-Mar-02	0.9	U	NO
IR07MWS-2	04-Jun-02	2.4	U	NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Lead (HGAL = 14.44 µg/L) (Continued)				
IR07MWS-2	28-Aug-02	1.4	U	NO
IR07MWS-2	19-Nov-02	0.7	U	NO
IR07MWS-2	04-Mar-03	0.9	U	NO
IR07MWS-2	20-May-03	2	U1	NO
IR07MWS-2	12-Aug-03	6.2	UJ	NO
IR07MWS-2	04-Nov-03	2.1	U	NO
IR07MWS-2	29-Mar-04	50	U	Limit > criterion
IR07MWS-2	07-Jun-04	10	UJ3	NO
IR07MWS-2	01-Sep-04	114		YES
IR20MW06A	24-May-93	13	U	NO
IR20MW06A	08-Sep-93	67.2	J23	YES
IR20MW06A	12-Jan-94	1.2	U	NO
IR07MW25A	26-Mar-04	10	U	NO
IR07MW25A	02-Jun-04	10	U	NO
IR07MW25A	01-Sep-04	28.4	J	YES
IR07MW25A	16-Nov-04	5	U	NO
IR07MW26A	29-Mar-04	50	U	Limit > criterion
IR07MW26A	03-Jun-04	10	U	NO
IR07MW26A	01-Sep-04	98.2	J	YES
IR07MW26A	16-Nov-04	25	U	Limit > criterion
Mercury (HGAL = 0.6 µg/L)				
IR26MW47A	12-Mar-02	0.4		NO
IR26MW47A	03-Jun-02	1.3		YES
IR26MW47A	03-Sep-02	1.6		YES
IR26MW47A	14-Nov-02	0.99		YES
IR26MW47A	11-Mar-03	0.18	B	NO
IR26MW47A	22-May-03	0.99		YES
IR26MW47A	13-Aug-03	2.64		YES
IR26MW47A	06-Nov-03	1.5		YES
IR26MW47A	29-Mar-04	1.45		YES
IR26MW47A	07-Jun-04	1.05		YES
IR26MW47A	07-Sep-04	2.4		YES
IR26MW47A	17-Nov-04	2.8		YES
PA50MW02A	31-Mar-93	0.18		NO
PA50MW02A	18-Aug-94	0.91		YES
PA50MW02A	15-Jun-95	0.1	U	NO
PA50MW02A	23-Jul-01	0.65		YES

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Mercury (HGAL = 0.6 µg/L) (Continued)				
IR20MW01A	19-May-93	0.2	U	NO
IR20MW01A	07-Sep-93	0.17		NO
IR20MW01A	11-Jan-94	2		YES
Nickel (HGAL = 96.48 µg/L)				
IR07MW20A2	29-Jul-91	98.55		YES
IR07MW20A2	04-Dec-91	102		YES
IR07MW20A2	04-Jun-92	92.9		NO
IR07MWP-1	30-Jul-91	7,120		YES
IR07MWP-1	03-Dec-91	993.5		YES
IR07MWP-1	02-Jun-92	890.5		YES
IR07MWP-2	30-Jul-91	651		YES
IR07MWP-2	05-Dec-91	436		YES
IR07MWP-2	04-Jun-92	234	J3	YES
IR07MWS-3	26-Jul-91	263		YES
IR07MWS-3	03-Dec-91	285		YES
IR07MWS-3	02-Jun-92	200	J3	YES
IR07MWS-4D	25-Jul-91	361		YES
IR07MWS-4D	02-Dec-91	322.5		YES
IR07MWS-1	29-Jul-91	282		YES
IR07MWS-1	04-Dec-91	322		YES
IR07MWS-1	03-Jun-92	143	J3	YES
IR07MWS-2D	26-Jul-91	153		YES
IR07MWS-2D	05-Dec-91	42.6		NO
IR07MWS-2D	03-Jun-92	17.3	UJ3	NO
IR26MW40A	06-Dec-94	40.75		NO
IR26MW40A	06-Jun-95	116		YES
IR26MW40A	08-Sep-95	18		NO
IR20MW06A	24-May-93	122		YES
IR20MW06A	08-Sep-93	80.7		NO
IR20MW06A	12-Jan-94	95.25		NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Selenium (HGAL = 14.5 µg /L)				
IR07MW26AD	02-Sep-99	3.9	U1	NO
IR07MW26AD	14-Jan-00	2.2	UJ1	NO
IR07MW26AD	25-Apr-00	4	U	NO
IR07MW26AD	07-Jul-00	2.7	UJ13	NO
IR07MW26AD	10-Oct-00	2	U	NO
IR07MW26AD	17-Jan-01	3	UJ1	NO
IR07MW26A	29-Mar-04	44.5	J	YES
IR07MW26A	03-Jun-04	35	U	Limit > criterion
IR07MW26A	01-Sep-04	73.7	J	YES
IR07MW26A	16-Nov-04	25	U	Limit > criterion
IR07MW19A	13-Mar-02	2	U	NO
IR07MW19A	31-May-02	3.2	UJ3	NO
IR07MW19A	28-Aug-02	3.6	U	NO
IR07MW19A	14-Nov-02	2.8	U	NO
IR07MW19A	04-Mar-03	2.9	U	NO
IR07MW19A	20-May-03	3.2	U	NO
IR07MW19A	13-Aug-03	3.9		NO
IR07MW19A	04-Nov-03	3.3	U	NO
IR07MW19A	23-Mar-04	27.55		YES
IR07MW19A	02-Jun-04	35	U	Limit > criterion
IR07MW19A	31-Aug-04	35	U	Limit > criterion
IR07MW20A1	04-Jun-02	3.2	U	NO
IR07MW20A1	29-Aug-02	3.6	U	NO
IR07MW20A1	14-Nov-02	2.8	U	NO
IR07MW20A1	05-Mar-03	2.9	U	NO
IR07MW20A1	21-May-03	3.2	U	NO
IR07MW20A1	14-Aug-03	2.5	U	NO
IR07MW20A1	04-Nov-03	3.3	U	NO
IR07MW20A1	24-Mar-04	43.55		YES
IR07MW20A1	02-Jun-04	35	U	Limit > criterion
IR07MW20A1	31-Aug-04	10.5		NO
IR07MWS-2	13-Mar-02	2	U	NO
IR07MWS-2	04-Jun-02	3.2	U	NO
IR07MWS-2	28-Aug-02	3.6	U	NO
IR07MWS-2	19-Nov-02	2.8	U	NO
IR07MWS-2	04-Mar-03	2.9	U	NO
IR07MWS-2	20-May-03	3.2	U	NO
IR07MWS-2	12-Aug-03	2.5	U	NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Selenium (HGAL = 14.5 µg /L) (Continued)				
IR07MWS-2	04-Nov-03	3.3	U	NO
IR07MWS-2	29-Mar-04	30.2	J	YES
IR07MWS-2	07-Jun-04	35	UJ3	Limit > criterion
IR07MWS-2	01-Sep-04	66.1	U	Limit > criterion
IR10MW31A1	23-Dec-93	2.7	U	NO
IR10MW31A1	11-Aug-94	6.9	U	NO
IR10MW31A1	23-May-95	3.5	U	NO
IR10MW31A1	03-Jun-02	3.2	U	NO
IR10MW31A1	29-Aug-02	3.6	U	NO
IR10MW31A1	19-Nov-02	2.8	U	NO
IR10MW31A1	05-Nov-03	3.3	U	NO
IR10MW31A1	22-Mar-04	19.6	J	YES
IR10MW31A1	07-Jun-04	35	UJ3	Limit > criterion
IR10MW31A1	02-Sep-04	35	U	Limit > criterion
Silver (HGAL = 7.43 µg/L)				
IR10MW14A	09-Mar-89	12.6		YES
IR10MW14A	22-Aug-90	1.6	U	NO
IR10MW14A	12-Jul-91	1.1	U	NO
IR10MW14A	14-Jan-92	1.7	U	NO
IR10MW13A2	09-Mar-89	20.7		YES
IR10MW13A2	22-Aug-90	1.6	U	NO
IR10MW13A2	11-Jul-91	1.1	U	NO
IR10MW13A2	13-Jan-92	4.9	U	NO
IR18MW21AD	28-Apr-93	8.83		YES
IR18MW21AD	08-Sep-93	1.3	U	NO
IR18MW21AD	12-Jan-94	3.6	U	NO
IR10MW13A1	09-Mar-89	16.2		YES
IR10MW13A1	22-Aug-90	1.6	U	NO
IR10MW13A1	11-Jul-91	1.1	U	NO
IR10MW13A1	12-Jul-91	1.1	U	NO
IR10MW13A1	13-Jan-92	4.9	U	NO
IR10MW15A	09-Mar-89	18.5		YES
IR10MW15A	22-Aug-90	1.6	U	NO
IR10MW15A	11-Jul-91	1.1	U	NO
IR10MW15A	15-Jan-92	1.7	U	NO
IR10MW15A	17-Jul-95	0.6	U	NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Zinc (Surface Water Criterion = 81 µg/L)				
IR26MW45A	07-Sep-99	2.35		NO
IR26MW45A	12-Jan-00	200		YES
IR26MW45A	26-Apr-00	1.5	U	NO
IR26MW45A	14-Jul-00	139		YES
IR26MW45A	11-Oct-00	1	U	NO
IR26MW45A	19-Jan-01	3	U	NO
IR07MW27A	02-Sep-99	8.1	U1	NO
IR07MW27A	13-Jan-00	116		YES
IR07MW27A	16-Oct-00	4.7	U1	NO
IR07MW27A	30-Apr-01	13.4	U2	NO
IR07MW27A	31-May-02	8.9	J	NO
IR07MW27A	15-Nov-02	15.5	J	NO
IR07MW27A	06-Mar-03	6	U	NO
IR07MW27A	18-Aug-03	14.8	U	NO
IR07MW27A	24-Mar-04	60	U	NO
IR07MW27A	03-Jun-04	60	U	NO
IR07MW27A	01Sep-04	600	U	Limit > criterion
IR20MW17A	05-May-94	2,580		YES
IR20MW17A	11-Aug-94	18.2		NO
IR20MW17A	06-Jun-95	63.9		NO
IR61MW05A	02-Oct-95	22	U1	NO
IR61MW05A	08-Nov-95	44.1	U1	NO
IR61MW05A	03-Sep-99	5.4	U	NO
IR61MW05A	13-Jan-00	152		YES
IR61MW05A	17-Oct-00	1	U	NO
IR61MW05A	30-Apr-01	10.3	U2	NO
IR61MW05A	03-Jun-02	7	U	NO
IR61MW05A	18-Nov-02	5.2	J	NO
IR61MW05A	10-Mar-03	29.6	B	NO
IR61MW05A	14-Aug-03	14.8	U	NO
IR61MW05A	29-Mar-04	60	UJ3	NO
IR61MW05A	01-Sep-04	600	U	Limit > criterion
IR10MW28A	31-Oct-91	6.1	U	NO
IR10MW28A	15-Jan-92	1.9	U	NO
IR10MW28A	07-Sep-99	48.8		NO
IR10MW28A	14-Jan-00	208		YES
IR10MW28A	13-Oct-00	1	U	NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Zinc (Surface Water Criterion = 81 µg/L) (Continued)				
IR10MW28A	26-Apr-01	19.7	U2	NO
IR10MW28A	04-Jun-02	7	U	NO
IR10MW28A	12-Nov-02	14	U2	NO
IR10MW28A	11-Mar-03	34.7	B	NO
IR10MW28A	19-Aug-03	14.8	U	NO
IR26MW42A	04-Dec-95	57.1	U1	NO
IR26MW42A	10-Jan-96	145		YES
IR26MW42A	12-Feb-96	33.6	U1	NO
IR07MWS-4DD	01-Sep-99	6.2	U1J9	NO
IR07MWS-4DD	13-Jan-00	227		YES
IR07MWS-4DD	25-Apr-00	3.8	U1	NO
IR07MWS-4DD	10-Jul-00	1.4	U	NO
IR07MWS-4DD	10-Oct-00	1	U	NO
IR07MWS-4DD	17-Jan-01	3	UJ3	NO
IR07MWS-4DD	17-Jan-01	3	UJ3	NO
IR07MW21A1D	29-Jul-91	13.2		NO
IR07MW21A1D	04-Dec-91	4.63		NO
IR07MW21A1D	03-Jun-92	16.5	U	NO
IR07MW21A1D	02-Sep-99	3	U	NO
IR07MW21A1D	13-Jan-00	184		YES
IR07MW21A1D	25-Apr-00	3	U1	NO
IR07MW21A1D	07-Jul-00	3.3	J	NO
IR07MW21A1D	07-Jul-00	7.3	J	NO
IR07MW24AD	02-Sep-99	3.8	U1	NO
IR07MW24AD	14-Jan-00	156		YES
IR07MW24AD	25-Apr-00	7.4	U1	NO
IR07MW24AD	14-Jul-00	5.9	U	NO
IR07MW24AD	13-Oct-00	4.55	U	NO
IR07MW24AD	18-Jan-01	3	U	NO
PA50MW01A	18-Mar-02	3.2	U	NO
PA50MW01A	04-Jun-02	172.25		YES
PA50MW01A	03-Sep-02	0.8	U	NO
PA50MW01A	18-Nov-02	26.5		NO
PA50MW01A	05-Mar-03	3	U	NO
PA50MW01A	21-May-03	6.8	U	NO
PA50MW01A	14-Aug-03	14.8	U	NO

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Zinc (Surface Water Criterion = 81 µg/L) (Continued)				
PA50MW01A	29-Mar-04	60	UJ3	NO
PA50MW01A	08-Jun-04	60	U	NO
PA50MW01A	02-Sep-04	60	U	NO
PA50MW01A	17-Nov-04	60	UJ39	NO
IR07MW26AD	02-Sep-99	5.3	U1	NO
IR07MW26AD	14-Jan-00	198		YES
IR07MW26AD	25-Apr-00	1.5	U	NO
IR07MW26AD	07-Jul-00	1.4	U	NO
IR07MW26AD	07-Jul-00	1.4	U	NO
IR07MW26AD	10-Oct-00	1	U	NO
IR07MW26AD	17-Jan-01	60	UJ3	NO
IR07MW23A	12-Jan-94	14.4	U2	NO
IR07MW23A	02-Sep-99	16.4	U1	NO
IR07MW23A	14-Jan-00	203		YES
IR07MW23A	13-Oct-00	1	U	NO
IR07MW23A	26-Apr-01	10.4	U2	NO
IR07MW23A	31-May-02	7	U	NO
IR07MW23A	15-Nov-02	6.6	J	NO
IR07MW23A	06-Mar-03	6	U	NO
IR07MW23A	18-Aug-03	14.8	U	NO
IR07MW23A	24-Mar-04	60	U	NO
IR07MW23A	03-Jun-04	60	U	NO
IR07MW23A	01-Sep-04	60	U	NO
Trichloroethene (Surface water screening criterion = 400 µg/L)				
IR10MW71A	29-Aug-03	610		YES
IR10MW71A	17-Nov-04	340		NO
IR10MW59A	31-May-02	240		NO
IR10MW59A	03-Sep-02	330		NO
IR10MW59A	13-Nov-02	410		YES
IR10MW59A	06-Mar-03	350		NO
IR10MW59A	22-May-03	120	J	NO
IR10MW59A	19-Aug-03	350		NO
IR10MW59A	19-Nov-04	1.3		NO
Pentachlorophenol (Surface water screening criterion = 7.9 µg/L)				
IR18MW21A	20-Nov-02	24		YES
IR18MW21A	20-Aug-03	25	U	Limit > criterion
IR18MW21A	06-Nov-03	25	U	Limit > criterion
IR18MW21A	25-Mar-04	25	U	Limit > criterion

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Pentachlorophenol (Surface water screening criterion = 7.9 µg/L) (Continued)				
IR18MW21A	07-Jun-04	25	UJ7	Limit > criterion
IR18MW21A	07-Sep-04	25	U	Limit > criterion
IR18MW21A	17-Nov-04	25	U	Limit > criterion
Alpha-chlordane (Surface water screening criterion = 0.004 µg/L)				
IR26MW46A	06-Mar-03	0.025	U	Limit > criterion
IR26MW46A	13-Aug-03	0.01	U	Limit > criterion
IR26MW46A	10-Nov-03	0.01325		YES
IR26MW46A	29-Mar-04	0.01	U	Limit > criterion
IR26MW46A	07-Jun-04	0.01	U	Limit > criterion
IR26MW46A	02-Sep-04	0.01	U	Limit > criterion
IR26MW46A	17-Nov-04	0.01	U	Limit > criterion
IR26MW47A	11-Mar-03	0.05	U	Limit > criterion
IR26MW47A	13-Aug-03	0.0051	J	YES
IR26MW47A	06-Nov-03	0.0007	J	NO
IR26MW47A	29-Mar-04	0.01	U	Limit > criterion
IR26MW47A	07-Jun-04	0.01	U	Limit > criterion
IR26MW47A	07-Sep-04	0.01	U	Limit > criterion
IR26MW47A	17-Nov-04	0.01	U	Limit > criterion
Gamma-chlordane (Surface water screening criterion = 0.004 µg/L)				
IR26MW46A	06-Mar-03	0.025	U	Limit > criterion
IR26MW46A	13-Aug-03	0.00615	U	Limit > criterion
IR26MW46A	10-Nov-03	0.01365		YES
IR26MW46A	29-Mar-04	0.01	U	Limit > criterion
IR26MW46A	07-Jun-04	0.01	U	Limit > criterion
IR26MW46A	02-Sep-04	0.01	U	Limit > criterion
IR26MW46A	17-Nov-04	0.01	U	Limit > criterion
IR18MW21A	04-Mar-03	0.0083	J	YES
IR18MW21A	06-Nov-03	0.003	UJ	NO
IR18MW21A	25-Mar-04	0.01	U	Limit > criterion
IR18MW21A	07-Jun-04	0.01	U	Limit > criterion
IR18MW21A	07-Sep-04	0.01	U	Limit > criterion
IR18MW21A	17-Nov-04	0.01	U	Limit > criterion
Heptachlor (Surface water screening criterion = 0.0036 µg/L)				
IR26MW48A	12-Mar-03	0.028		YES
IR26MW48A	13-Aug-03	0.013	U	Limit > criterion
IR26MW48A	05-Nov-03	0.05	U	Limit > criterion
IR18MW21A	04-Mar-03	0.011	J	YES
IR18MW21A	06-Nov-03	0.0081	UJ	Limit > criterion

TABLE I-6: EVALUATION OF GROUNDWATER SAMPLES THAT EXCEED SURFACE WATER QUALITY CRITERIA (CONTINUED)

Appendix I, Parcel B Technical Memorandum in Support of a Record of Decision Amendment
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceeded Criterion
Heptachlor (Surface water screening criterion = 0.0036 µg/L) (Continued)				
IR18MW21A	25-Mar-04	0.01	U	Limit > criterion
IR18MW21A	07-Jun-04	0.01	U	Limit > criterion
IR18MW21A	07-Sep-04	0.01	U	Limit > criterion
IR18MW21A	17-Nov-04	0.01	U	Limit > criterion
IR26MW43A	15-Nov-95	0.01		YES
IR26MW43A	19-Dec-95	0.01	U	Limit > criterion
IR26MW43A	01-Feb-96	0.01	U	Limit > criterion
IR26MW47A	11-Mar-03	0.028	J	YES
IR26MW47A	13-Aug-03	0.017	U	Limit > criterion
IR26MW47A	06-Nov-03	0.0089	U	Limit > criterion

Notes: **Bold** results indicate the maximum detected concentration for each well.
Surface water criteria derivation discussed in Section I2.1 of this appendix, and listed in Table I-1.

-- Not applicable

µg/L Microgram gram per liter

B Detected in blank

HGAL Hunters Point groundwater ambient level

J Estimated detected result

U Nondetected result

ATTACHMENT I1
RESPONSES TO COMMENTS ON APPENDIX I OF THE DRAFT FINAL TMSRA

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the regulatory agencies on Appendix I (Trigger Levels for Groundwater Impacts to San Francisco Bay) of the “Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard [HPS], San Francisco, California,” dated August 6, 2007. The table below contains responses to comments submitted by Mr. Erich Simon of the San Francisco Bay Regional Water Quality Control Board (Water Board) on September 12, 2007. Mr. Mark Ripperda of the U.S. Environmental Protection Agency (EPA) and Mr. Thomas Lanphar of the Department of Toxic Substances Control (DTSC) informed the Navy via e-mail on September 10, 2007, that they would not provide comments. Responses to comments made by the Water Board were also adjusted to address informal comments on the responses to comments received from Mr. Simon on October 5, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, and table numbers pertain to Appendix I of the draft final TMSRA, even though some of these numbers have changed in Appendix I of the final TMSRA.

No.	Page	Comment	Response
General Comments			
1.	---	We appreciate that the regulators concerns have been addressed by utilizing an attenuation factor of 1:1 in the tidal mixing zone and basing attenuation modeling on a dispersion-only scenario. Even though an attenuation factor of 1:1 was utilized, there are several sections in this appendix that indicate that dilution of groundwater discharge to the bay is appropriately considered as a potential attenuation processes. While dilution may be occurring in the tidal mixing zone, please revise the report to clearly indicate that the Water Board does not allow for dilution of groundwater in surface water. Also, when discussing the Water Board position regarding attenuation of groundwater discharge to the bay, please include reference to our March 16, 2006 position letter on groundwater evaluation criteria and points of compliance.	<ul style="list-style-type: none"> The Navy appreciates the Water Board’s efforts to achieve a solution to this complex issue. The responses to the specific comments below contain further details on revisions made to the appendix to clarify the attenuation processes. The text of Section I4.3.3 was expanded to add the following paragraph: “<i>The Water Board’s position related to the Eastshore Park Property is that the 10 times dilution was a site-specific determination and is not directly applicable to HPS. The Water Board does not allow modeling to incorporate dilution of groundwater contaminants in surface water. The Water Board’s position regarding attenuation of groundwater discharge to the bay at HPS is further discussed in a letter to the Navy dated March 16, 2006 (Water Board 2006b).</i>”

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2.	---	<p>Throughout this Appendix, the position is presented that conservative measures were used throughout this evaluation. While this is the case in several instances, the screening process selected to evaluate which wells will be compared with trigger levels may be less conservative. Numerous chemicals have been removed from consideration based on the screening process outlined in Section 13.0, even though they may have constituent concentrations above trigger levels. These wells may have been appropriately removed from consideration because of reducing concentrations, isolated exceedances, or other reasons, but it's hard to determine based on the information presented in this appendix. Were some of the wells that exhibited high concentrations in historical samples sampled again after the high concentrations were detected? In cases where wells were excluded from further consideration, we request more data be presented or referenced, including a discussion of at least the 12 most recent sample concentrations. Please also include information on whether reported sample concentrations are representative and whether seasonal fluctuation or tidal variation in results may influence data interpretation.</p>	<ul style="list-style-type: none"> • Concentration data indicated that, for all 12 chemicals of potential ecological concern (COPEC) that were eliminated, detections that exceeded each surface water quality criterion were isolated and infrequent and were followed by results for at least one sample (but often for several samples) that did not exceed the surface water quality criterion. Seasonal fluctuations also were considered in the data evaluation. The text of Section 13.0 was revised to clarify the evaluation process. Also see the response to specific comment 3. • Current groundwater data will be evaluated during the remedial design for all wells where the analysis presented in Appendix I indicated trigger levels were exceeded. Wells that were installed after the cut-off date for the trigger level evaluation (November 2004) will also be included in the assessment during the remedial design. • The majority of the data evaluated in Appendix I were collected as part of the remedial action monitoring program (RAMP) for Parcel B. Under the RAMP, groundwater samples are collected quarterly and, therefore, address potential seasonal fluctuations. Many of the wells evaluated in Appendix I are far from the shoreline, and contaminant concentrations in groundwater for those wells will not be influenced by tidal variations. Approximately 65 of the 116 wells evaluated in Appendix I are located inland of the tidally influenced zone (see Figure I-1 for the location of the tidally influenced zone). Although tidal variations were taken into account when groundwater elevations were measured in wells near the shoreline, tides were not considered in scheduling sampling. Groundwater samples have been collected randomly with respect to tides for more than 30 quarters at Parcel B. The sample concentrations measured are considered to represent groundwater conditions in the aquifer.

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
Specific Comments			
1.	I-3	Section 12.0 – Selection of Surface Water Quality Criteria to be Applied to Groundwater – Page I-3 - Third Paragraph – Please revise to include reference the most recent versions on the Water Quality Control Plan (12/22/06 - http://www.waterboards.ca.gov/sanfranciscobay/basinplan.htm), and the Compilation of Water Quality Goals (8/07 – http://www.swrcb.ca.gov/rwqcb5/available_documents/wq_goals/).	<ul style="list-style-type: none"> The cited references were updated in the text of Appendix I. Table I-1 was also updated to be consistent with the updated references.
2a.	I-7	Section 13.0 – Groundwater Screening Results – Page I-7 – Bottom paragraph – The data set used for screening groundwater data included “the most recent 12 samples from each well at Parcel B using samples collected through November 2004”. Please also indicate the time that the 12 most recent samples may span, how recent the most recent samples are, whether they represent samples collected throughout the year, and at what point of the tidal cycle for wells located in tidal influence areas. Please also indicate whether any new wells have been installed after November, 2004, and discuss how data from these wells will be considered in the final remedy selected at this site	<ul style="list-style-type: none"> The use of the most recent 12 samples of groundwater for each well and the November 2004 cut-off date for the data set were agreed with the regulatory agencies during negotiations on the approach to the human health risk assessment in 2004. The time spanned by the 12 most recent samples and the duration of the span varies by well and cannot be concisely summarized, except for wells that are included in the RAMP. The 12 most recent samples typically extend over 12 consecutive quarters from March 2002 to November 2004 for wells that are included in the RAMP (also refer to Table 2-3 in the main TMSRA for a summary of wells in the RAMP). The duration of the 12 most recent samples, the date of the most recent sample, and the distribution of samples throughout the year for any specific well can be identified using the data tool in Appendix F of the TMSRA. As discussed in the response to general comment 2, tidal influence was not considered during the sampling schedule. Wells that were installed after the cut-off date for the trigger level evaluation (November 2004) will also be included in the assessment during the remedial design. Examples of new wells at Parcel B include IR26MW49A, IR26MW50A, IR10MW81A, and IR10MW82A. The following additional evaluations may occur for cases where the data from these new wells indicate concentrations consistently exceed a trigger level: <ul style="list-style-type: none"> Increasing the frequency of monitoring in the well where the trigger level was exceeded to evaluate whether the elevated level is persistent; Monitoring groundwater at a location farther downgradient to evaluate whether the attenuation estimated in establishing the trigger level has occurred;

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2a. (cont.)	I-7	(see above)	<ul style="list-style-type: none"> Using site-specific detailed information to more accurately estimate attenuation, including processes such as adsorption and degradation); or Implementing a selected remediation alternative for groundwater treatment. Section I5.0 was expanded to include a statement that newly installed wells will be included in the evaluation process during the remedial design.
2b.	I-8	Page I-8 – Top Paragraph – Second to last sentence – We do not agree with the statement that a lack of an established criterion for surface water quality indicates that regulatory agencies do not consider these chemicals to be significant threats to environmental receptors. In some cases, there may not be enough data to confidently set an appropriate limit at this time. Please delete this sentence.	<ul style="list-style-type: none"> The cited sentence was deleted.
3.	I-9	Section I3.1 – Chemicals Eliminated as COPECs – Page I-9 – While we agree with the approach to screen data from wells using the 3 screening criteria listed in Section I3.0, the decision logic for eliminating individual chemicals is not readily apparent. Please elaborate on which screening criteria were relied upon to eliminate the chemicals listed in the table in this section from further consideration. Please see General Comment#2.	<ul style="list-style-type: none"> The text of Section I3.1 was modified as follows: “Refinement of the list of COPECs included evaluation of the frequency the water quality screening level was exceeded and the date the most recent elevated level was detected <i>focused on the trend in detections—especially consistent detections and whether the most recent samples from a well did not exceed the surface water quality criterion. Seasonal fluctuations also were considered in the data evaluation. The table below summarizes the 12 COPECs that were eliminated from further consideration based on the results presented below evaluation. Concentration data indicated that detections for all 12 COPECs at Parcel B that exceeded each surface water quality criterion were isolated and infrequent and were followed by results for at least one sample (but often for several samples) that did not exceed the surface water quality criterion.</i>” No COPECs were eliminated based only on frequency of detection or date of sample collection.
4.	I-10	Section I3.2 – Chemicals of concern – Page I-10 – This section identifies which chemicals were identified as chemicals of concern (COCs), based on the well-by-well evaluation. Please clarify whether these COCs are to be considered across Parcel B, or only at those wells that were used to identify them as COCs.	<ul style="list-style-type: none"> The text of Section I3.2 was modified as follows: “Based on the well-by-well evaluation, chromium VI, copper, lead, mercury and nickel were identified as COCs. <i>Each chemical is considered a COC for groundwater at the location of the well where it exceeds the corresponding surface water quality criterion and not for all groundwater at Parcel B.</i>”

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
5.	I-11	<p>Section I3.2.5 – Nickel – Page I-11 – This paragraph describes that nickel was excluded as a COC because the nickel concentrations detected in wells impacted by sea water were not representative of nickel concentrations in the groundwater. Based on Figure I-1, one of the wells that consistently had high concentrations (Well IR07MWS-1) is not within the tidal mixing zone. Please provide further justification for why these high nickel concentrations were eliminated from consideration or revise the text to indicate that Nickel is a COC based on data collected from this well.</p>	<ul style="list-style-type: none"> Well IR07MWS-1 was inadvertently included in the group of wells that the Navy studied and found to be affected by leaching from stainless steel well casing and screen. The text of Section I3.2.5 was revised as follows: “Nickel was originally identified as a COC because it was detected at concentrations that exceeded the HGAL [Hunters Point groundwater ambient level] (96.48 µg/L) in samples collected from several wells in the IR-07 area of Parcel B. Of the 415 groundwater samples collected at Parcel B wells, 19 exceeded the HGAL for nickel. Table I-6 shows elevated concentrations of nickel in samples from wells IR07MWP-1, IR07MWP-2, IR07MWS-1, IR07MWS-3, and IR07MWS-4D (see Figure I-1). All Four of the five of these wells (all except IR07MWS-1) are located near San Francisco Bay in an area where groundwater contains high concentrations of chloride. All five four wells were installed using stainless steel casing and well screens. The Navy studied the concentrations of nickel in the A-aquifer groundwater near these wells by installing and sampling adjacent wells with polyvinyl chloride (PVC) casing and screens. Groundwater samples collected from wells constructed with PVC materials did not indicate elevated concentrations of nickel, and the Navy concluded that the source of nickel in these wells was leaching of nickel from the well casing and screen caused by corrosion of the stainless steel well components in the high-chloride groundwater environment (IT Corporation 1999). These stainless steel wells have all since been decommissioned. Therefore, nickel was excluded as a COC <i>in these four wells</i> because the nickel concentrations of concern were not related to groundwater conditions in the aquifer. <i>Nickel was identified as a COC at well IR07MWS-1 because results for three samples exceeded the HGAL. Table I-6 shows elevated concentrations of nickel in samples from well IR07MWS-1 (see Figure I-1). Although well IR07MWS-1 was also constructed using stainless steel casing and well screen, this well was not included in the nickel study at IR-07 discussed above, and concentrations of chloride in groundwater near IR07MWS-1 are lower than in the vicinity of the other four wells which are nearer to the bay than IR07MWS-1. Therefore, nickel was identified as a COC and included in the trigger level evaluation.</i>” Nickel was carried forward into the development of trigger levels and Section I5.0 was revised accordingly to include well IR07MWS-1. However, nickel concentrations at well IR07MWS-1 do not exceed the trigger level calculated for that location. The maximum concentration of nickel in groundwater collected at well IR07MWS-1 was 322 µg/L while the calculated trigger level for that location was 386 µg/L.

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
6.	I-12	Section 14.1 – Attenuation During Groundwater Transport to Tidal Mixing Zone – Page I-12 – Bottom Paragraph – The attenuation factors developed for Parcel D are also applied for Parcel B. Please indicate whether site specific conditions relevant to Parcel B may change the applicability of these attenuation factors that were developed for Parcel D. Will different hydrogeologic conditions or presence of preferential pathways at Parcel B impact the dispersion-only modeling approach used to develop the attenuation factors?	<ul style="list-style-type: none"> Site-specific aquifer conditions (for example, aquifer hydraulic conductivity) at Parcel B are considered sufficiently similar to Parcel D. No adjustment to the modeling approach used at Parcel D is necessary to apply the results to Parcel B. Preferential pathways are not considered a likely pathway for groundwater flow at Parcel B. The Navy studied the storm drain system at Parcel B in 1997 (Tetra Tech 1998) and 1999 to 2000 (Tetra Tech 2001). The latter investigation included excavating the storm drains at two reaches in IR-07 and IR-24. The investigation found that the soil texture and permeability of pipe backfill materials were not significantly different from the surrounding fill. Furthermore, removal of all storm drain and sanitary sewer lines at Parcel B as part of the radiological removal program has confirmed these observations. All storm drain and sanitary sewer lines at Parcel B have been or will be removed. The report was not changed as a result of this comment.
7.	I-17	Section 14.3.3 –RWQCB Approach – Page I-17 – Please clearly indicate that while the Water Board allowed a 10x attenuation factor above the 50-foot shoreline buffer at the Eastshore Park Property in Berkeley, this was a site specific determination and is not directly applicable to site specific conditions at Hunters Point. This comment is also applicable to Section 14.4.	<ul style="list-style-type: none"> The text of Section 14.3.3 was expanded to add the following paragraph: <i>“The Water Board’s position related to the Eastshore Park Property is that the 10 times dilution was a site-specific determination and is not directly applicable to HPS. The Water Board does not allow modeling to incorporate dilution of groundwater contaminants in surface water. The Water Board’s position regarding attenuation of groundwater discharge to the bay at HPS is further discussed in a letter to the Navy dated March 16, 2006 (Water Board 2006b).”</i>
8a.	I-18	Section 14.4 – Summary of Attenuation Mechanisms for Chemicals in Groundwater –Page I-18 – Top Paragraph – Please discuss whether site specific hydrogeologic data were used in developing the attenuation factors for Parcel B. Please also include a discussion of whether an evaluation of potential preferential pathways was conducted at this Parcel and how they may influence attenuation factors used at this Parcel.	<ul style="list-style-type: none"> Please refer to the response to specific comment 6. The report was not changed as a result of this comment.

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
9a.	I-19	<p>Section I5.0 – Development of Parcel B Trigger Levels – Page I-19 – Proposed Trigger Levels Table – This table indicates that an attenuation factor of 4.5 is proposed for well IR10MW12A and an attenuation factor of 4 is proposed for IR20MW01A. Please explain whether these proposed attenuation factors are based on distance of the wells to the shore or to the inland edge of the tidal mixing zone. As an attenuation factor of 1 was applied to the wells within the tidal mixing zone, the proposed attenuation factors for the inland wells should be based on distance from the well to the tidal mixing zone. Please revise as necessary.</p>	<ul style="list-style-type: none"> • The attenuation factors presented in Appendix I apply to the distance to the sediment-surface water interface, and not to the inland edge of the tidal mixing zone. (See the model description in Section I4.1.) Attenuation caused by dispersion continues to occur as groundwater travels through the tidal mixing zone to the bay. The trigger level model does not account for dilution based on mixing with seawater in the tidal mixing zone, but dispersion and its resultant attenuation will continue to occur as groundwater moves through the tidal mixing zone. The calculated attenuation factor for wells near the shoreline was 1, but this does not imply there is no attenuation near the shoreline — only that the amount of attenuation is small. The calculated attenuation factors for wells near the shoreline were rounded back to 1 to maintain the overall, highly conservative approach used in developing trigger levels. • In the case of mercury at well IR20MW01A, the attenuation factor is applied to the HGAL because the HGAL (0.6 µg/L) is greater than the surface water quality criterion (0.025 µg/L) (refer to Section I2.3 for further discussion of ambient groundwater concentrations). The maximum concentration of mercury in groundwater collected at well IR20MW01A was 2.0 µg/L while the calculated trigger level for that location was 2.4 µg/L. • The report was not changed as a result of this comment.
9b.	I-20	<p>Page I-20 – Second Paragraph – This paragraph suggests that the inclusion of the six wells that are above screening levels will be based on the concentrations observed in groundwater at these wells at the time the design is prepared. This approach may exclude wells that have a temporary reduction in concentrations due to sampling after recent infiltration events, or during high tide for tidally influenced wells, or due to other temporary influences on the wells. Inclusion of the wells should be based on more than just the concentration at the time the design is prepared. Please revise paragraph to indicate that at least the 12 most recent samples will be used, assuming these samples are representative of seasonal variations and consider tidal fluctuations that may occur at these wells.</p>	<ul style="list-style-type: none"> • The most recent 12 samples available at the time the design is prepared will be used to reassess the trends in groundwater concentrations at the six wells identified by the trigger level analysis. The most recent 12 samples from wells that were installed after the cut-off date for the trigger level evaluation (November 2004) will also be included in the assessment during the remedial design.

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
9b. (cont.)	I-20	(see above)	<ul style="list-style-type: none"> Section 15.0 was revised as follows: "As discussed in Section 5.3.2 of the TMSRA, the details of groundwater monitoring program will be identified during the remedial design. Inclusion of the six wells... not sampled since that time. Evaluations in the remedial design will consider current data <i>the most recent 12 samples for the six wells listed above</i> and will not be limited to the data set ending in November 2004 that was used for the trigger level analysis. These newer data collected since November 2004 may indicate that monitoring is no longer necessary (for example, if the data show concentrations are consistently below the trigger level). <i>The most recent 12 samples from wells that were installed after the cut-off date for the trigger level evaluation (November 2004) will also be included in the assessment during the remedial design.</i> Complete discussions of these evaluations will be contained in the remedial design for review by the regulatory agencies."
9c.	I-20	Page I-20 – Bullet list – 3 rd bullet – Please specify that site specific detailed information may be used to more accurately estimate attenuation in the inland areas, not in the tidal mixing zone.	<ul style="list-style-type: none"> Other attenuation processes, such as adsorption, occur in the tidal mixing zone as well as in inland areas. Because of the conservative estimates used in the initial evaluation of attenuation at Parcel B, the Navy may consider other attenuation processes in evaluating site-specific information in the event trigger levels are consistently exceeded at a monitoring well. The site-specific detailed information may include adsorption in both inland areas and in the tidal mixing zone. The report was not changed as a result of this comment.
10a.	I-24	<p>Section 16.3 – Uncertainty in Calculating Trigger Levels – Page I-24 – Please also include discussion about the uncertainty in measured concentrations of chemicals of concern because of the following possible scenarios:</p> <ul style="list-style-type: none"> only old data is available, only a few measurements at a location were taken, and some wells were eliminated from consideration even though concentrations may be above trigger levels 	<ul style="list-style-type: none"> The following text was added to Section 16.2: <i>"The data set used to derive the AFs [attenuation factors] adds some uncertainty. In some cases, few measurements were collected at a location or the only data available were collected many years ago. Both of these factors may limit the representativeness of the data evaluated for these wells. However, data for all wells were considered in the evaluation, and trigger levels were developed despite these limitations. For example, a trigger level was calculated for copper at well IR07MW20A2 even though only three samples were collected and the most recent was collected in June 1992."</i> No wells with concentrations that exceeded a trigger level were eliminated from consideration unless subsequent samples indicated concentrations below the trigger level.

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
10b.	I-24	Page I-24 – Second Paragraph – Last sentence – This statement indicates that it is expected that most chemicals discharged from groundwater to the bay will be quickly adsorbed to sediment or precipitate out. As adsorption and precipitation are very chemical- and matrix-specific, please revise this sentence to read, “The calculation also assumes that 100 percent of the chemical remains in the dissolved state even after it has been discharged to the bay, despite expectations that some constituents may be quickly adsorbed to sediment or precipitate out.”	<ul style="list-style-type: none"> The text of Section 16.3 has been revised as requested: “The calculation also assumes that 100 percent of the chemical remains in the dissolved state even after it has been discharged to the bay, despite all reasonable expectations that much will <i>some constituents may</i> be quickly adsorbed to sediment or precipitate out.”
11a.	I-24	Section 17.0 – Summary and Conclusions – Page I-24 – Second Paragraph – This paragraph indicates that while no water quality criteria exist for groundwater at Parcel B, analysis of attenuation factors identified several constituents that have the potential to impact the bay. Please clarify that drinking water quality criteria are directly applicable to the B-aquifer at Parcel B, and indicate whether any constituents are present at levels that exceed applicable drinking water quality standards.	<ul style="list-style-type: none"> Appendix I focuses on protection of surface water receptors; drinking water criteria are not relevant in this appendix. Please refer to Appendix E for further discussion of the beneficial uses of groundwater, including the B-aquifer as a potential source of drinking water. The report was not changed as a result of this comment.
11b.	I-26	Page I-26 – Last Paragraph – Please elaborate how wells with trigger level exceedances in post-2004 data, which was not used in this evaluation, will be handled.	<ul style="list-style-type: none"> Section 17.0 was expanded to include a statement that newly installed wells will be included in the evaluation process during the remedial design.
12.	---	Table I-1 – Surface Water Quality Criteria for the San Francisco Bay Footnotes - Please update references to both the San Francisco Bay Basin Plan and A Compilation of Water Quality Goals. See Specific Comment #1.	<ul style="list-style-type: none"> Table I-1 was updated to be consistent with the updated references.
13.	---	Table I-2 – Comparison of Groundwater to Surface Water Quality Criteria – Metals This table indicates that the surface water quality criterion for selenium is 71 ug/L, which is the lowest CTR salt water criterion in this table. While this seems appropriate, footnote q in this table indicates that the fresh water quality criterion for selenium is applicable specifically to the waters of the San Francisco Bay. Considering this, the most appropriate surface water quality criterion for selenium is 5.0 ug/L. Please revise this table and the text of the appendix as appropriate to include a discussion of selenium, based on a comparison with this lower criterion.	<ul style="list-style-type: none"> Tables I-1 and I-2 were revised to include 5.0 µg/L as the surface water quality criterion for selenium based on Table 3-3 of the Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin (Water Board 2006a). The table contained in Section 13.1 was updated to revise the frequency of detection for selenium from 1 of 377 to 6 of 377. However, selenium remained one of the COPECs that was eliminated and no additional changes to the text of Appendix I were necessary.

TABLE I1-1: DRAFT RESPONSES TO COMMENTS FROM THE REGULATORY AGENCIES ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
14.	---	<p>Table I-6 – Evaluation of Groundwater Samples that Exceed Surface Water Quality Criteria – While this table only includes sample results that exceeded applicable criteria, the last 12 sample results for those wells that had exceedances should also be presented in this table or elsewhere, assuming they are representative of seasonal variations and tidal fluctuations. Including this information or providing a reference to it would help to assess whether concentrations are stable, increasing, or decreasing over time.</p>	<ul style="list-style-type: none"> Table I-6 presents all 12 data results for each chemical at every well where the chemical exceeded the surface water quality criterion at least once. However, 12 samples were not available for all wells. Appendix F contains data for any samples collected before the 12-sample data set in cases where more than 12 samples have been collected. The report was not changed as a result of this comment.

TABLE I1-2: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON APPENDIX I OF THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the City and County of San Francisco (City) on Appendix I (Trigger Levels for Groundwater Impacts to San Francisco Bay) of the “Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated August 6, 2007. Comments were submitted by Amy Brownell (City) on September 14, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, and table numbers pertain to Appendix I of the draft final TMSRA, even though some of these numbers have changed in Appendix I of the final TMSRA.

No.	Page	Comment	Response
General Comment			
1.	---	Multiple chemicals were eliminated as Chemicals of Potential Ecological Concern (COPECs) based upon the frequency of detections exceeding the applicable water quality criterion. While the groundwater data that formed the basis for the trigger levels was the 12 rounds of groundwater sampling that was used in the human health risk assessment for the Parcel B TMSRA, a frequency of detection evaluation was not part of the chemical of concern/data evaluation tasks developed for the human health risk assessment. Therefore additional information is required to justify the elimination of COPECs.	<ul style="list-style-type: none"> The text of Section I3.1 was modified as follows: “Refinement of the list of COPECs included evaluation of the frequency the water quality screening level was exceeded and the date the most recent elevated level was detected <i>focused on the trend in detections—especially consistency, magnitude that a criterion was exceeded, and whether concentrations detected below the surface water quality criterion were found in samples collected after samples that did exceed the criterion. Seasonal fluctuations also were considered in the data evaluation. The table below summarizes the 12 COPECs that were eliminated from further consideration based on the results presented below evaluation. Concentration data indicated that detections for all 12 COPECs at Parcel B that exceeded each surface water quality criterion were isolated and infrequent and were followed by results for at least one sample (but often for several samples) that did not exceed the surface water quality criterion.</i> No COPECs were eliminated based only on frequency of detection or date of sample collection.
		Specific criteria (i.e., minimum frequency detection for retention of a COPEC) should be discussed in this section or chemical-specific rationale should be presented similar to Section I3.2 (Chemicals of Concern) to clarify why chemicals have been eliminated as COPECs. It appears that multiple criteria may have been used since zinc was eliminated (13 detections above the criterion out of 437 samples) while lead was retained (8 detections above the criterion out of 408 samples).	<ul style="list-style-type: none"> As discussed in the response to the previous comment, no COPECs were eliminated based only on frequency of detection. Zinc was eliminated because in all 13 cases where a concentration exceeded the surface water quality criterion (81 µg/L from the Basin Plan), the detections that exceeded the criterion were sporadic and there was at least one subsequent sample below the criterion. Lead was retained as a COPEC at wells IR07MWS-2 and IR26MW48A because the last sample collected at each well exceeded the surface water quality criterion (14.44 µg/L HGAL). Lead was eliminated in the other six cases for the same reasons as zinc.

REFERENCES

- IT Corporation. 1999. "Draft Final Report of Groundwater Nickel Plume Delineation, A-Aquifer, Parcel B, Hunters Point Shipyard, San Francisco, California." Revision B. February.
- San Francisco Bay Regional Water Quality Control Board (Water Board). 2006a. "Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin." Available online at: <http://www.waterboards.ca.gov/sanfranciscobay/basinplan.htm>
- Water Board. 2006b. Letter Regarding Groundwater Evaluation Criteria, Points of Compliance, and Next Steps, Hunters Point Shipyard, San Francisco. From Mr. Jim Ponton, Water Board. To Mr. Keith Forman, Base Realignment and Closure (BRAC) Environmental Coordinator, Navy BRAC Program Management Office West. March 16.
- Tetra Tech EM Inc. (Tetra Tech). 1998. "Draft Storm Drain Infiltration Study at Parcel B, Hunters Point Shipyard, San Francisco, California." April 24.
- Tetra Tech. 2001. "Final Technical Memorandum, Parcel B Storm Drain Infiltration Study, Hunters Point Shipyard, San Francisco, California." February 28.

APPENDIX J
METALS CONCENTRATIONS IN FRANCISCAN BEDROCK OUTCROPS STUDY
REPORT

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Metals Concentrations in Franciscan Bedrock Outcrops

Hunters Point Shipyard
San Francisco, California

Contract No. N67811-02-D-8213

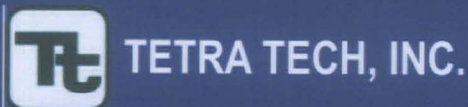
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Prepared by:



March 17, 2004

**METALS CONCENTRATIONS IN
FRANCISCAN BEDROCK OUTCROPS:
Three Sites in the Hunters Point Shear Zone
and Marin Headlands Terrane Subunits
Hunters Point Shipyard, San Francisco, California**

March 17, 2004

Prepared for





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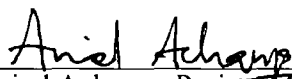
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FIGURES

- 1 Regional Map of Study Sites
- 2 Street Maps of the Study Sites
- 3 Distribution of Franciscan Bedrock in Central and Northern California
- 4 Distribution of Franciscan Rocks in the San Francisco Bay Area
- 5 Geological Map of San Francisco

ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
Cal/EPA	California Environmental Protection Agency
COPC	Chemical of potential concern
DTSC	California Department of Toxic Substances Control
ELCR	Excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
FSP/QAPP	Field sampling plan and quality assurance project plan
HI	Hazard index
HPS	Hunters Point Shipyard
HQ	Hazard quotient
mg/kg	Milligrams per kilogram
Navy	U.S. Department of the Navy
PRG	Preliminary remediation goal
PRRL	Project-required reporting limit
Shaw	Shaw Environmental, Inc.
Tetra Tech	Tetra Tech EM Inc.

EXECUTIVE SUMMARY

This study characterizes ambient metals concentrations in bedrock and bedrock-derived soils from three nonindustrial sites in San Francisco, California. The three sites have a similar geologic setting to Hunters Point Shipyard, an industrial site that is located on the eastern side of San Francisco and owned by the U.S. Department of the Navy (Navy). Hunters Point Shipyard and the three study sites contain serpentinite, chert, and basalt bedrock typical of the Franciscan Complex. The Franciscan Complex is the predominant bedrock unit in the California Coast Ranges. The selected sites (Innes Avenue, Twin Peaks Boulevard, and Malta and O'Shaughnessy) are located in two Franciscan Complex subunits: (1) the Hunters Point Shear Zone and (2) the Marin Headlands Terrane.

About 30 rock and soil samples (91 total) were collected from a grid at each of the 3 sites. The rock samples were collected with a rock hammer and the soils by excavation with a trowel to a depth of 3 feet below ground surface. The samples were analyzed for the standard suite of metals by U.S. Environmental Protection Agency (EPA) methods; the rock samples were pulverized before analysis.

As typical of these rock types, elevated concentrations of arsenic, iron, and manganese were found at the chert sites, while elevated concentrations of nickel were found at the serpentinite site. The chemical composition of soil at the three sites was found to be similar to the chemical composition of rock because (1) the soil is very young and (2) the soil is composed primarily of fragments of bedrock. However, the metals concentrations in soil and bedrock did differ in several ways, mainly due to the presence of other rock types such as basalt and sandstone.

The potential risk to human health posed by the ambient metal concentrations at these sites was also evaluated by estimating the hazard index (non-cancer risk) and the excess lifetime cancer risk using adjusted EPA preliminary remediation goals. The hazard index from all samples collected at the bedrock sites ranged from 4.7 to 63, and is attributable primarily to manganese and nickel. The excess lifetime cancer risk for all samples collected at the study sites ranged from 1.2×10^{-6} to 1.6×10^{-4} , and is attributable primarily to arsenic.

1.0 INTRODUCTION

The purpose of this study is to characterize the metals concentrations in bedrock and bedrock-derived soils that represent three geological formations (serpentinite, chert, and basalt) typical of the Franciscan Complex. Concentrations of naturally occurring metals in these Franciscan bedrock types have not been well characterized at nonindustrial sites in San Francisco (Figure 1), California. The three study sites have geologic settings similar to the Hunters Point Shipyard (HPS) in San Francisco. Knowledge of the normal range of ambient metals concentrations at nonindustrialized sites with a similar geological setting to HPS will provide a better understanding of risks posed by naturally occurring serpentinite, chert, and basalt bedrock (Figures 2, 3, and 4).

To characterize ambient metals concentrations, bedrock and bedrock-derived soil samples were collected at three selected nonindustrial sites (Figure 5) containing Franciscan Complex serpentinite, chert, and basalt bedrock. Of the three sites selected, the Innes Avenue site is characterized by serpentinite, and the Twin Peaks Boulevard site and Malta and O'Shaughnessy site are characterized by chert. The sites are located in two Franciscan Complex subunits: (1) the Hunters Point Shear Zone and (2) the Marin Headlands Terrane.

This technical memorandum contains the following sections:

- Section 2.0 presents the geologic background of the Franciscan Complex.
- Section 3.0 describes data collection procedures.
- Section 4.0 presents a statistical evaluation of metals data from the nonindustrial sites.
- Section 5.0 presents a human health risk evaluation of the metals data from the nonindustrial sites.
- Section 6.0 summarizes the study results.
- Section 7.0 lists the references used to prepare this document.

Figures, tables, and appendixes follow the text portion of this report. Appendix A presents the field and laboratory data reports. Appendices B and C present the results for the statistical and risk evaluations, respectively. Appendix D presents photographs of field activities.

2.0 GEOLOGIC SETTING

This section discusses the geological background of the study area, including the origin and structure of the Franciscan complex (Section 2.1), the Franciscan subunits found in San Francisco (Section 2.2); the chemistry of Franciscan chert and serpentinite (Section 2.3), and the geology of each study site and the reference site (Section 2.4).

Bedrock found in San Francisco is a part of the Franciscan Complex, the predominant bedrock unit of the California Coast Ranges (Figure 2). Franciscan and similar rocks occur from southern Oregon to near Santa Barbara, California (Bailey and others 1964). Franciscan rocks comprise a diverse group of rocks assembled by the process of subduction (Wakabayashi 1992, 1999a, and references therein). During subduction, one of the Earth's plates plunges beneath another. Subduction complexes such as the Franciscan consist of a seemingly chaotic mixture of a variety of rock types scraped off the top of the downgoing oceanic plate by the upper continental plate. The material scraped off during subduction consists of two components: (1) the upper part of the subducting oceanic crust, and (2) sediments derived from the continental margin. The former consist of rocks such as basalt and chert, whereas the latter consist of sands, silts, and muds that formed sandstones, siltstones, and shales. Rocks such as serpentinite from the upper mantle of the upper plates may also become incorporated into the subduction complex.

The Franciscan Complex rocks formed between 200 million and 20 million years ago and were brought together to form the subduction complex from about 165 million to 10 million years ago (Wakabayashi 1992, 1999a). Basalt scraped off the downgoing plate originated as submarine volcanism either at a mid-ocean spreading ridge or as part of a seamount or oceanic plateau (Shevats 1990). Chert originated as siliceous ooze derived from the skeletons of microscopic marine organisms known as radiolaria (Murchey and Jones 1984). These materials accumulated on the basalt of the ocean floor and were eventually covered by much greater volumes of sand, silt, and mud eroded from the continental margin. Serpentinite likely originated when crustal extension exposed upper mantle rocks near the intersection of mid-ocean ridges and their offsetting transform faults, thereby permitting retrograde metamorphism (Tucholke and others 1998).

Because of the dynamic processes during subduction, major subunits of subduction complexes are separated by faults that may range from features a few meters wide to shear zones several kilometers in thickness. The thicker or wider fault zones commonly have a matrix of sheared and weak rock, usually shale and serpentinite, which surrounds harder blocks of a variety of rock types. In the Franciscan Complex, such geologic subunits are often classified as either "coherent" or *mélange* (Wakabayashi 1992, 1999a). Each coherent (or non-*mélange*) subunit is cut by many faults, but normal depositional contacts, in which sandstone overlies chert and chert overlies basalt, are also common. Many coherent subunits of the Franciscan Complex have been called terranes (Blake and others 1982; Blake and others 1984) or nappes (Wakabayashi 1992, 1999a). In any given region, the Franciscan Complex comprises a stack of coherent subunits (nappes or terranes) bounded by low-angle faults; this stack of units is folded in regional-scale folds that are several kilometers in amplitude and continue along the strike fault for distances of tens of kilometers. Erosion has exposed the limbs of these folds as belts or strips of Franciscan units, which give the characteristic pattern of elongate geologic subunits seen on geologic maps of the California Coast Ranges (Wakabayashi 1999a).

The folds and nappes of the Franciscan have undergone further dissection by strike-slip faulting associated with the San Andreas transform fault system; this fault system has affected the Coast Ranges from 18 million years ago to the present, with the time of faulting initiation varying by latitude (Wakabayashi 1999a, 1999b). Locally extensive volcanism in the Coast Ranges followed the initiation of transform faulting (Johnson and O'Neil 1984; Fox and others 1985), and this volcanism has also created various mineral deposits including mercury and gold (Rytuba 1996).

The types of structures and rocks found in the Franciscan Complex are common to subduction complexes found throughout the world (Ernst 1971; Maruyama and others 1996). Multiple subduction complexes are found on every continent, and many are associated with the Pacific Rim. In western North America, subduction complexes are common in Alaska, British Columbia, Oregon, California, and Baja California. The Franciscan Complex is not the only subduction complex found in California; multiple subduction complexes are also found in the Klamath Mountains and the Sierra Nevada range.

2.2 FRANCISCAN SUBUNITS IN THE SAN FRANCISCO AREA

The Franciscan Complex in the San Francisco area (Figure 3) forms several fault-bounded coherent terranes or nappes bounded by low-angle shear (mélange) zones (Blake and others 1984; Wakabayashi 1992). This stack of nappes is folded into regional-scale folds so that the regional dips within San Francisco are to the northeast (Wahrhaftig 1984). As a result of the folding of the various Franciscan units, as well as post-Franciscan strike-slip faulting, the Franciscan terranes or nappes found in San Francisco occur elsewhere in the Bay region. The Franciscan rocks within San Francisco formed from about 200 to 85 million years ago and were brought together as part of the Franciscan Complex from about 100 to 80 million years ago (Wakabayashi 1992). Within San Francisco, three coherent terranes (the Alcatraz, Marin Headlands, and San Bruno Mountain) are separated by two mélange zones (the Hunters Point Shear Zone and the City College fault zone). From structurally high to structurally low, the coherent and mélange subunits are as follows:

1. The Alcatraz Terrane is composed of sandstone and shale forming prominent exposures on Telegraph Hill and neighboring areas.
2. The Hunters Point Shear Zone is composed of a sheet of variably sheared serpentinite with minor gabbro lenses and is bounded above and below by shale-matrix mélange. This unit has its most prominent exposures in the Hunters Point, Potrero Hill, and Fort Point areas (the latter is the south abutment of the Golden Gate Bridge).
3. The Marin Headlands Terrane consists of basalt, chert, sandstone, and shale. This unit includes the southern part of Hunters Point, but the most extensive and prominent exposures occur in the Twin Peaks-Diamond Heights area, with other major exposures in the Bernal Heights and Candlestick Point areas.

4. The City College Fault Zone consists of shale matrix *mélange*. This unit is rather poorly exposed, with some outcrops in the Sunnydale area and at the City College of San Francisco campus.
5. The San Bruno Mountain Terrane consists of sandstone and shale. This unit makes up San Bruno Mountain and underlies much of the Sunset District.

2.3 GEOLOGIC IMPACT ON ROCK CHEMISTRY

Chemistry of the rocks of the Franciscan Complex is influenced by several factors, including the composition of the rock when it originally formed, subsequent metamorphism, late stage hydrothermal alteration associated with San Andreas-age volcanic activity, and weathering.

In the California Coast Ranges, hydrothermal activity associated with volcanism along the San Andreas fault system has resulted in important economic mineral deposits, especially of mercury and gold, (Rytuba 1996). Hydrothermal veins attributed to this igneous activity have been found on San Bruno Mountain (Underwood and others 1999), but it is not known whether any mineralization associated with such hydrothermal systems affects the rocks within other parts of the San Francisco.

Weathering and soil development can locally influence the composition of the rock and the soil derived from it. Where natural soils have developed for thousands or hundreds of thousands of years or more, certain elements have become enriched in these soils, while other elements have been leached and lost to solution (Brimhall and Dietrich 1987). The study sites soils are less than 100 years old, as the roadcuts in the bedrock were made about 100 years or so ago, and the soils must be younger than the roadcuts.

For the Franciscan bedrock in San Francisco, the most important influence on chemistry is the original composition of the rock. Two types of Franciscan bedrock common in San Francisco and throughout the Coast Ranges have particularly high concentrations of certain metals compared to cleanup standards for HPS. These two rock types are chert and serpentinite. Basalt has relatively high average values of manganese, generally in the range of 1,000 to 2,000 milligrams per kilogram (mg/kg) (Giaramita and others 1998), and the concentrations of certain metals are locally elevated, particularly near contacts where chert depositionally overlies basalt (Chyi and others 1984; Huebner and Flohr 1990). In addition, Franciscan sandstones have arsenic concentrations that may range to 20 mg/kg or higher. Although sandstones and basalts may have comparatively high concentrations of certain metals, chert and serpentinite commonly have the highest relative concentrations of various metals of concern. As a result, the following discussion will focus on chert and serpentinite.

2.3.1 Chert

Pure chert would consist almost entirely of silica or silicon-dioxide. However, various processes add additional elements to cherts in place of silica. Among the most important of these are the

activity of submarine hot springs that bring up waters rich in metals, resulting in precipitation of various mineral deposits on the sea floor. Such springs include well-known "black smokers" or hot springs near mid-ocean spreading ridges. Such deposits may be enriched in manganese and other metals, including lead, barium, and arsenic. Because the hot springs occur at or near a spreading ridge, deposits of such origin are expected in the stratigraphically lowest cherts overlying basalt, as well as interbedded in the stratigraphically highest part of the basalt. Such expectation is borne out by the occurrence of the largest manganese ore deposits along basalt-chert contacts (Chyi and others 1984; Huebner and Flohr 1990). Manganese ore bodies large enough for economic exploitation have been found associated with several Franciscan chert bodies, including some associated with the Marin Headlands Terrane in Sausalito and Red Rock (island south of Richmond-San Rafael Bridge) (Murdoch and Webb 1966).

High levels of manganese may also occur on the ocean floor in nodules formed at colder springs at great distances from spreading ridges. These nodules result in locally high concentrations of manganese and other metals higher in the chert section (relative to the basal contact over basalt). The association of high concentrations of manganese and other related metals with chert is common throughout the world and has been known for many decades (Bradley and others 1918; Trask and others 1943; Audley-Charles 1965; Bonatti and others 1976). Manganese and other (non-silicon) metals in chert are irregularly distributed in cherts of comparatively low metamorphic grade, such as those within San Francisco. As a result, metal concentrations can be highly variable within a comparatively small area within a chert body. At higher metamorphic grade, cherts become recrystallized, and manganese and various other metals are mobilized to form metamorphic minerals such as stilpnomelane and spessartine, which are more evenly distributed through the rock mass. However, metacherts with manganese-bearing metamorphic minerals (and more homogeneously distributed manganese and other metals) are largely absent in San Francisco, with the exception of a few tectonic blocks in *mélange* found in the Baker Beach area and interbeds within a small fault-bounded sheet in McLaren Park (Wakabayashi 1990).

2.3.2 Serpentinite

Serpentinite forms by hydration of the mantle rock peridotite. The serpentinization process can occur beneath the sea floor within an actively forming subduction complex, and even within near-surface groundwater on-land. This process results in the replacement of the primary peridotite minerals of olivine and various pyroxenes with serpentine minerals and magnetite. Serpentinites and their parent peridotites have higher concentrations of nickel, chromium, and cobalt than any other rock type (Goff and Lackner 1998; Brimhall and Dietrich 1987). Nickel and cobalt tend to have relatively consistent and comparatively homogeneous distribution in serpentinite because they occur as trace constituents of the main serpentine minerals. Chromium has highly variable concentrations in serpentinite because it is associated with discrete mineral grains of chromite (also called chromian spinel). If a sample of serpentinite is lacking in chromite, the chromium concentration may be relatively low; however, even a few chromite grains in the sample will result in high chromium concentration. Discrete lenses of chromite in serpentinite have been economically exploited as chromium ore. A number of such mines were developed in California, although none were developed in San Francisco (Murdoch and Webb 1966). Similar to chert, the serpentinites of San Francisco and the Franciscan Complex are

essentially the same in chemical composition as serpentinites found throughout the world (Coleman 1977; Goff and Lackner 1998) and the compositions of them have been known for many decades (Bradley and others 1918).

2.4 SITE GEOLOGY

The three sites evaluated in this study are all located in San Francisco, and all involve Franciscan bedrock in a lithologic setting similar to HPS. The site located near the intersection of Malta Drive and O'Shaughnessy Boulevard, at the edge of Glen Canyon Park, and the site at Twin Peaks Boulevard, contain chert and basalt outcrops. The site located west of the intersection of Innes Avenue and Aurelius Walker Drive contains serpentinite bedrock outcrops. This site is near the Navy's HPS industrial reference site.

The three study sites are all located in non-industrial-designated zones. Historic Sanborn® Maps were reviewed to evaluate the potential for industrial activities at these sites. A review of maps dated between 1900 and 1991 indicates that these sites were not used for industrial operations.

2.4.1 Innes Avenue

The Innes Avenue site in the Hunters Point area consists of a bedrock exposure of serpentinite in a roadcut with soil occurring on a less steep area above the roadcut and draped along the base of the roadcut. The serpentinite at the site consists of fairly massive serpentinitized harzburgite (originally olivine and orthopyroxene) that is part of the serpentinite associated with the Hunters Point Shear Zone. The soil is thin (generally less than 1 foot) and appears to be displaced and young, as it contains materials of human origin throughout. Bedrock on the slopes above the site is also serpentinite. Some pieces of chert can be found in the soil; these were likely derived from fill placed as road base material.

2.4.2 Twin Peaks Boulevard

The Twin Peaks site is located on the top of Twin Peaks in basalt and chert of the Marin Headlands Terrane. Part of the site consists of the roadcut near the top of the northern peak in addition to the area above this roadcut. Although the ground surface above this roadcut capping the hill may be natural, very little soil formed on it, probably because of the efficiency of erosional processes at this location. Soil on the top of the northern hill appeared to be no deeper than 1.5 feet or so.

2.4.3 Malta and O'Shaughnessy

The Malta and O'Shaughnessy site is located along a roadcut in chert and basalt of the Marin Headlands Terrane. The exposure is a steep slope that extends upwards for 50 feet or more above the road level. Soil occurs only at the base of the slope and is composed mainly of rock fragments that have fallen from the roadcut. Bedrock above the roadcut is chert. No older

natural soils are found at the site. A depositional contact of chert over basalt is found in the roadcut along Malta Avenue.

2.4.4 Hunters Point Shipyard

The Navy's HPS, which has a similar geological setting to the three study sites, is located on a peninsula within the Hunters Point Shear Zone, a northwest-trending belt of Franciscan Complex bedrock. Underlying the Hunters Point Shear Zone at HPS is the Marin Headlands Terrane. Rocks within this belt are intensely deformed and sheared, and form a serpentinite and mélange belt. Five geologic units underlie HPS; the youngest is of Quaternary age, and the oldest is of Jurassic-Cretaceous age. In general, the stratigraphic sequence of these geologic units, from youngest (shallowest) to oldest (deepest), is as follows: Artificial Fill, Undifferentiated Upper Sand Deposits, Bay Mud Deposits, Undifferentiated Sedimentary Deposits, and Franciscan Complex bedrock.

3.0 DATA COLLECTION

In January 2003, bedrock sites were selected during field reconnaissance conducted by the Navy, John Wakabayashi, and Shaw Environmental & Infrastructure, Inc. (Shaw). In April, May, and June 2003, Shaw collected samples from rock outcrop areas at Innes Avenue, Malta Drive and O'Shaughnessy Boulevard, and Twin Peaks Boulevard (Figure 5). At each site, two sample grids—one for rock and one for soil—were outlined and logged using hand-held global positioning system monitors. Each grid (30 feet or less on each side) was divided into 150 cells, and a random number generator was used to select 15 sampling points for each grid. The sample points were located in the field by measuring from one corner of the grid; all locations were noted in the field logbooks. Bedrock samples were collected from natural outcrops using a pre-cleaned rock hammer. Soil samples were collected by excavation with a trowel to maximum depths of 1.5 feet (Innes), 3 feet (Twin Peaks), and 7 inches (Malta) below ground surface. Samples were placed into pre-cleaned 8-ounce jars with Teflon lids and were shipped to Applied Physical and Chemical Laboratory of Chino, California. Samples were analyzed by U.S. Environmental Protection Agency's (EPA) SW-846 (EPA 1996) Method 6010 for metals; EPA Method 7471 for mercury; and EPA Method 9030B for soluble acid sulfides. Prior to analysis, the contracted laboratory pulverized the rock samples in compliance with American Society for Testing and Materials (ASTM) methods (ASTM D5730-98) (ASTM 2002).

The field sampling, laboratory analyses, and data management procedures for this study are described in detail in the project field sampling plan and quality assurance project plan (FSP/QAPP) (Tetra Tech EM Inc. [Tetra Tech] 2003). The Twin Peaks site was substituted for the Wisconsin and 22nd Street site described in the FSP/QAPP due to lack of access to the Wisconsin and 22nd Street site.

Appendix A presents field and laboratory data reports, including a review of data quality. Photographs of field activities are presented in Appendix D.

As shown in the FSP/QAPP (Tetra Tech 2003), the selected analytical methods and associated project-required reporting limits (PRRL) are capable of quantifying the metals at concentrations below the residential preliminary remediation goal (PRG) in most cases. Metals concentrations were reported as estimated values if concentrations are greater than instrument detection limits but less than PRRLs. The instrument detection limit for each analyte was listed as the reporting limit in the laboratory's electronic data deliverable.

4.0 EVALUATION OF ANALYTICAL RESULTS

This section presents evaluations of the analytical results. Section 4.1 discusses the study sample size. Section 4.2 presents basic descriptive statistics for the results, and Section 4.3 is a chemical and geological evaluation of the results.

4.1 SAMPLE SIZE

About 30 samples (15 rock and 15 soil) were collected at each reference site. This sample size was chosen based on an estimate of the expected variability or spatial heterogeneity in metals concentrations at the study sites, based on data collected at the HPS reference site (Tetra Tech 2003).

Identifying chemicals of potential concern (COPC) is not a part of this study. Nevertheless, guidance in identifying COPCs at hazardous waste sites may be relevant when comparing results from the three nonindustrial sites to conditions documented at HPS. The California Department of Toxic Substances Control (DTSC) provides the following guidance (DTSC 1997):

Multiple measurements of a metal in either ambient or site soils will describe a distribution of concentrations for that metal. When few data are available, this distribution may be described only poorly; perhaps only the central tendency may be estimated with confidence. When large data sets are available, the extremes of distributions are more likely to be adequately characterized. Depending on the size of the ambient data set and its quality, the 95th or even the 99th percentile might be an appropriate criterion for the upper range of ambient concentrations. When sample sets for ambient conditions are large, it is often possible to use an estimate of an upper percentile of ambient concentrations as the value to be compared with C_{max} [the highest concentration] detected for the site.

The basic method for identifying metals which are COPC is to compare the highest detected concentration at the site to a value representative of the upper range of the ambient distribution. When few data are available to describe ambient conditions, both the shape of the ambient distribution and its upper extremes are uncertain and the value representative of ambient conditions should be a measure of central tendency. When ambient conditions are well described, an estimate of an upper percentile of the ambient distribution may be used. In all cases, the Wilcoxon rank sum test may be used as an adjunct to the comparison method.

The best description of ambient conditions will be obtained from the largest data set possible. Under favorable conditions, the data set describing ambient conditions may be expanded to include samples from other studies or even possibly contaminated areas.

4.2 STATISTICAL EVALUATION

The analytical results for metals in soil and rock samples collected at the three study sites are presented in Appendix A. Appendix B presents tables summarizing descriptive statistics for the metals concentrations by site, by sample matrix (rock and soil), and by rock type (chert and serpentinite). The summaries include the distribution for each metal; the frequency of detection; the minimum and the maximum value for censored (nondetect) and detected data; and the median, 95th quantile, mean, standard deviation, coefficient of variation, and 95th upper confidence limit for the detected and censored data combined. The statistical tests applied to each parameter are described in detail in the table footnotes, and in a method summary included in Appendix B.

Appendix B also provides graphical depictions of the statistical analyses performed on the field and laboratory data. Box-and-whisker plots show the metals concentrations at each site for rock, soil, and both matrices combined, as well as by rock type (chert and serpentinite), and for all sites combined. The plots indicate the median concentrations and the 10, 25, 75, and 90 percent quantiles. Appendix B also provides box-and-whisker plots for metals identified as risk drivers (Section 5.0), which are plotted by rock type and for all three sites combined.

4.3 CHEMICAL AND GEOLOGICAL EVALUATION

Metals data collected from the three study sites is consistent with other studies of chert and serpentinite. As typical of these rock types, elevated concentrations of arsenic, iron, and manganese were found at the chert sites, while elevated concentrations of nickel were found at the serpentinite site. Data indicate that the chemical composition of soil at the three sites is similar to the chemical composition of rock. This similarity is expected because the soil is very young and is composed primarily of fragments of bedrock. The soils are too young for leaching and enrichment processes to have significantly altered their soil chemistry.

Despite their overall similar chemistry, soil and bedrock differ in the following ways:

- Chert site soils showed comparatively smaller compositional differences between soil and nearby rock compared to the Innes Avenue serpentinite site. Differences observed at the serpentinite site may be related to the types of non-serpentinite rock in the soil. At the chert sites, rock clasts are fairly similar to the chert present, while at Innes Avenue, the non-serpentinite rocks are not at all similar to serpentinite.

- At the Innes Avenue serpentinite site, soils are higher in aluminum, arsenic, barium, calcium, lead, manganese, potassium, vanadium, and zinc than serpentinite bedrock. Although the bedrock in the vicinity of the site is entirely serpentinite, pieces of chert are found in the soil indicating that fill of various origins is part of the soil. The higher soil concentrations of arsenic, barium, lead, manganese, and zinc can be attributed to pieces of chert fill in the soil. The higher concentrations of aluminum, calcium, and potassium most likely result from pieces of basalt or sandstone fill, both of which are also common as fill materials at HPS.
- At the chert sites, soil concentrations of calcium, potassium, and magnesium are greater than in rock. Basalt and sandstone are both present in the area, and small fragments of these rocks may contribute to elevated concentrations of these three elements in soil.
- Despite higher soil concentrations of calcium, potassium, and manganese at the chert sites, aluminum concentrations are not higher in soil than in bedrock. Where basalt and sandstone occur, aluminum is typically associated with calcium, potassium, and magnesium. Most calcium and potassium in basalt and sandstone is present in aluminum-bearing minerals, and most aluminum in basalt is present in minerals that have calcium, iron, magnesium, or sodium. A likely explanation for lower than expected aluminum concentrations is that most of the aluminum is from the mineral kaolinite. Kaolinite is a hydrous alumino-silicate that often forms as a weathering product of feldspars. The aluminum content of rock and soil from kaolinite may be so great that other sources of aluminum are not significant. These other sources may include calcium, potassium, and magnesium-bearing minerals such as weathered and unweathered feldspars, micas, pyroxenes, amphiboles, and calcium-bearing metamorphic minerals. This explanation is consistent with the fact that aluminum concentrations in rock and soil are an order of magnitude higher than calcium, magnesium, and potassium. These concentrations would be expected to be the same order of magnitude if kaolinite was not the primary aluminum-bearing mineral.
- Lead concentrations are similar at both the serpentinite and chert sites, and lead concentrations are higher in soil than in rock. This suggests that the higher concentrations in soils may be mainly a result of emissions from automobiles burning leaded gasoline. Lead in automobile emissions is a common mechanism of soil-lead contamination within the last several decades (the age of the deposits). No other source of lead can readily account for the higher concentration of lead in very young soils relative to parent rock.

5.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the general methodology used in the human health risk assessment (Section 5.1) and summarizes results for cancer and noncancer risks (Section 5.2).

5.1

RISK CALCULATION METHODOLOGY

The potential risk to human health posed by the ambient metal concentrations at these sites was evaluated by estimating the excess lifetime cancer risk (ELCR) and hazard index (HI) for residential exposure to metals. To estimate the ELCR and HI for each sampling location, metals data from the three regional bedrock sites were compared to HPS-specific PRGs. HPS-specific PRGs are health-based concentrations for individual chemicals in soil and correspond to an ELCR of 1×10^{-6} or a noncancer hazard quotient (HQ) of 1. HPS-specific PRGs assume the following exposure pathways:

- Ingestion of soil
- Dermal contact with soil
- Inhalation of volatiles and particulates from soil
- Ingestion of homegrown produce

The exposure parameters and toxicity values used to calculate the HPS PRGs were based on the exposure parameters and toxicity values used to develop the EPA Region IX residential PRGs (EPA 2002), with the exception of the homegrown produce pathway and California Environmental Protection Agency (Cal/EPA) toxicity criteria. Exposure parameters used to calculate the homegrown produce pathway were derived from EPA sources. Cal/EPA toxicity criteria were used in lieu of EPA toxicity criteria when the Cal/EPA toxicity criteria were more conservative. For metals with both carcinogenic and noncarcinogenic endpoints, separate HPS-specific PRGs were calculated for both endpoints.

The risk calculation methodology is detailed in Appendix C. Appendix C also includes graphs of the ELCR and the HI calculated for each site and for all study sites combined (Figures C-1 through C-8).

5.1.1 Carcinogenic Risks

For carcinogens, the cancer risk associated with exposure to a single metal is estimated by comparing the metals concentration in a given sample to the carcinogenic HPS-specific PRG, using the following equation:

$$\text{Cancer Risk} = (C/\text{HPS-specific PRG}) \times 10^{-6}$$

where:

C	=	Metal concentration in given sample (mg/kg)
HPS-specific PRG	=	Hunters Point Shipyard-specific carcinogenic preliminary remediation goal (mg/kg)

The total ELCR from exposure to multiple metals is calculated using the following equation:

$$ELCR = 10^{-6} \times \{(C_1/\text{HPS-specific PRG}_1) + (C_2/\text{HPS-specific PRG}_2) + (C_n/\text{HPS-specific PRG}_n)\}$$

where:

ELCR	=	Estimated lifetime cancer risk from exposure to all metals (unitless)
C_n	=	Concentration of metal n (mg/kg)
HPS PRG _n	=	Hunters Point Shipyard-specific carcinogenic preliminary remediation goal for metal n (mg/kg)

5.1.2 Noncancer Health Hazards

For metals not classified as carcinogens and for those carcinogens known to cause adverse health effects other than cancer, the potential for residents to develop adverse health effects is evaluated by comparing the metals concentrations to the noncancer HPS-specific PRGs. When calculated for a single metal, this comparison estimates an HQ and is expressed in the following equation:

$$HQ = C/\text{HPS-specific PRG}$$

where:

HQ	=	Metal-specific individual hazard quotient
C	=	Metal concentration in given sample (mg/kg)
HPS PRG	=	Hunters Point Shipyard-specific noncarcinogenic preliminary remediation goal (mg/kg)

To evaluate the potential for noncarcinogenic effects from exposure to multiple metals, the HQs for all chemicals are summed, yielding an HI as follows:

$$HI = \{(C_1/\text{HPS-specific PRG}_1) + (C_2/\text{HPS-specific PRG}_2) + (C_n/\text{HPS-specific PRG}_n)\}$$

where:

HI	=	Cumulative hazard index from exposure to all metals (unitless)
C_n	=	Concentration of metal n (mg/kg)
HPS PRG _n	=	Hunters Point Shipyard-specific noncarcinogenic preliminary remediation goal for metal n (mg/kg)

A total HI of less than 1 indicates no potential for adverse noncarcinogenic health effects. If the HI exceeds 1, it may indicate the potential exists for adverse noncarcinogenic health effects to occur.

5.2 RISK EVALUATION

The potential carcinogenic risks and noncancer health hazards were evaluated by estimating the ELCR and HI for each of the sampling locations using the methodology outlined above. For each sample, the detected concentration of each metal was compared to the HPS-specific PRG. For metals that were not detected in a given sample, a value of one-half the detection limit was compared to the HPS-specific PRG. ELCRs and HIs are presented in the following sections.

5.2.1 Innes Avenue

In all of the samples, most of the cancer risk is attributed to arsenic. The ELCR for samples collected at the Innes Avenue site is presented on Figure C-1. ELCRs for samples collected at the Innes Avenue site ranged from 1.2×10^{-6} to 1.6×10^{-5} . The ELCR from 24 of the 33 samples (about 75 percent) was below 1×10^{-5} ; the ELCR from the remaining samples was between 1×10^{-5} and 1×10^{-6} .

The HI ranged from 4.8 to 15 for samples collected at the Innes Avenue site, and is primarily attributed to manganese and nickel (Figure C-2).

5.2.2 Twin Peaks Boulevard

In all of the samples, most of the cancer risk is attributed to arsenic. The ELCR from samples collected at the Twin Peaks Boulevard site is presented on Figure C-3. ELCRs ranged from 9.1×10^{-6} to 1.6×10^{-4} for samples collected at the Twin Peaks Boulevard site. The ELCR from 29 of the 34 samples (about 85 percent) ranged between 1×10^{-5} and 1×10^{-4} ; the ELCR from 4 of the 34 samples (about 12 percent) was greater than 1×10^{-4} . The ELCR from the remaining sample was below 1×10^{-5} .

The HI ranged from 9.8 to 63 for samples collected at the Twin Peaks Boulevard site, and is primarily attributed to manganese and iron (Figure C-4).

5.2.3 Malta and O'Shaughnessy

In all of the samples, most of the cancer risk is attributed to arsenic. The ELCR from samples collected at the Malta and O'Shaughnessy site is presented on Figure C-5. ELCRs ranged from 5.4×10^{-6} to 1.4×10^{-4} for samples collected at the Malta and O'Shaughnessy site. The ELCR from 28 of the 33 samples (about 85 percent) ranged between 1×10^{-5} and 1×10^{-4} ; the ELCR from 4 of the 33 samples (about 12 percent) was greater than 1×10^{-4} . The ELCR from the remaining sample was below 1×10^{-5} .

The HI for samples ranged from 4.7 to 36 collected at the Malta and O'Shaughnessy site, and is primarily attributed to manganese and iron (Figure C-6).

5.2.4 Overall Risk Evaluation

The ELCR for samples collected at the bedrock sites ranged from 1.2×10^{-6} to 1.6×10^{-4} . The ELCR from 26 of the 100 samples (26 percent) was below 1×10^{-5} ; the ELCR of 66 of the 100 samples (66 percent) was between 1×10^{-5} and 1×10^{-4} ; and the ELCR from the remaining 8 samples (approximately 8 percent) was greater than 1×10^{-4} . In all of the samples, most of the cancer risk is attributed to arsenic. The ELCR from all samples collected at the study sites are presented on Figure C-7.

The HI from all samples collected at the study sites ranged from 4.7 to 63 and is primarily attributed to manganese and nickel (Figure C-8).

6.0 SUMMARY

Samples were collected from three nonindustrial sites in San Francisco to determine ambient metals concentrations in bedrock and bedrock-derived soils containing Franciscan Complex serpentinite and chert. These sites – Innes Avenue (serpentinite), Twin Peaks Boulevard (chert), and Malta and O'Shaughnessy (chert) - are located in two Franciscan Complex subunits: (1) the Hunters Point Shear Zone and (2) the Marin Headlands Terrane. The sites have a similar geologic setting to HPS, an industrial site on the eastern side of San Francisco. About 30 samples were collected from each site (91 total).

As typical of these rock types, elevated concentrations of arsenic, iron, and manganese were found at the chert sites, while elevated concentrations of nickel were found at the serpentinite site. The chemical composition of soil at the three sites was found to be similar to the chemical composition of rock. However, the metals concentrations in soil and bedrock did differ in several ways, mainly due to the presence of other rock types such as basalt and sandstone also present at HPS.

The potential risk to human health posed by the ambient metal concentrations at these sites was also evaluated by estimating the HI and the ELCR using adjusted EPA PRGs. The HI from all samples collected at the bedrock sites ranged from 4.7 to 63. The HI is attributable primarily to manganese and nickel. The ELCR for all samples collected at the study sites ranged from 1.2×10^{-6} to 1.6×10^{-4} . Most of the cancer risk is attributed to arsenic. Of the 91 samples collected and analyzed, none met the cleanup standards for unrestricted residential reuse at HPS.

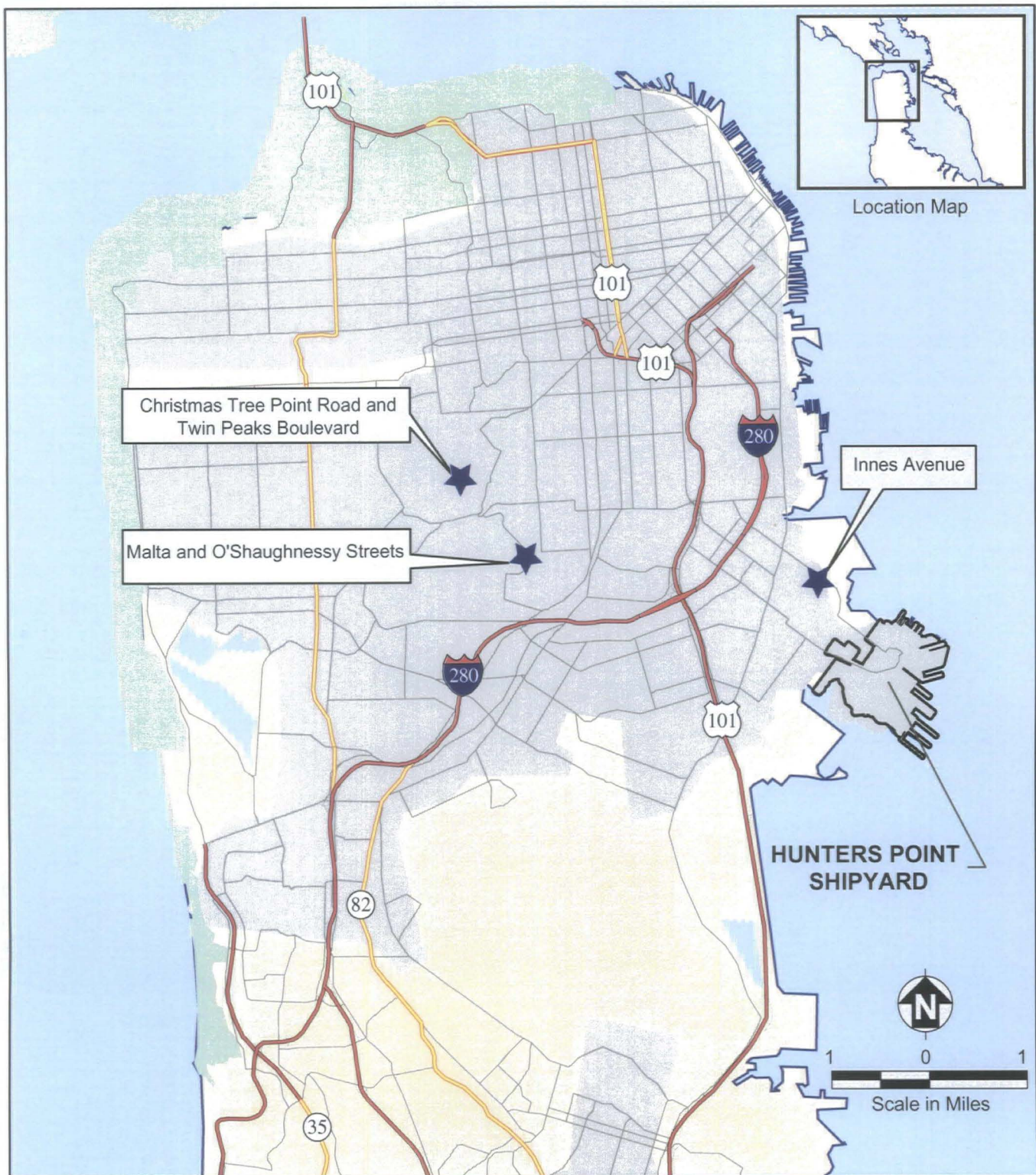
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FIGURES



Proposed Bedrock Sample Sites



Parks (Regional)



Lakes (Regional)



Urban Areas (Regional)

Road Classification

— Limited Access Highway

— Highway

— Local Roads

— Ramps

— — — Other

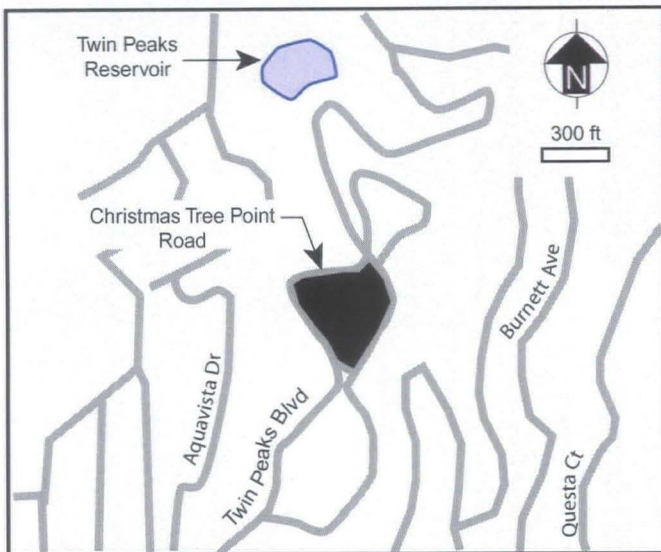
Tt Tetra Tech EM Inc.

Hunters Point Shipyard, San Francisco, California
U.S. Navy Southwest Division, NAVFAC, San Diego

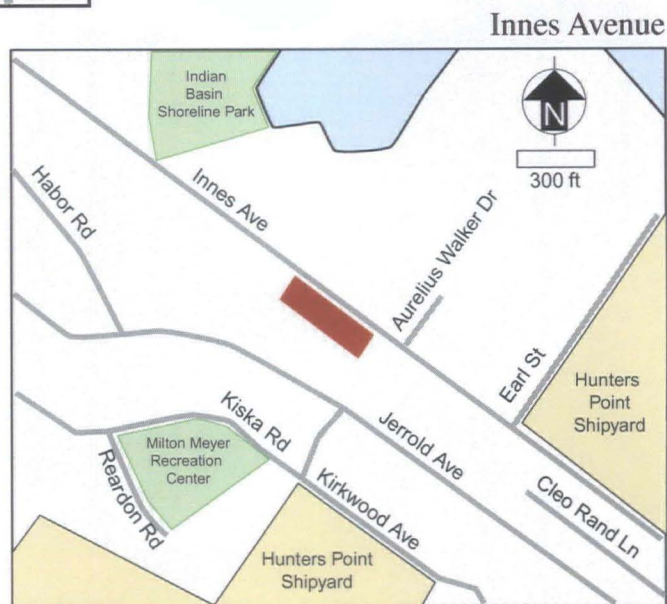
FIGURE 1

REGIONAL MAP OF STUDY SITES

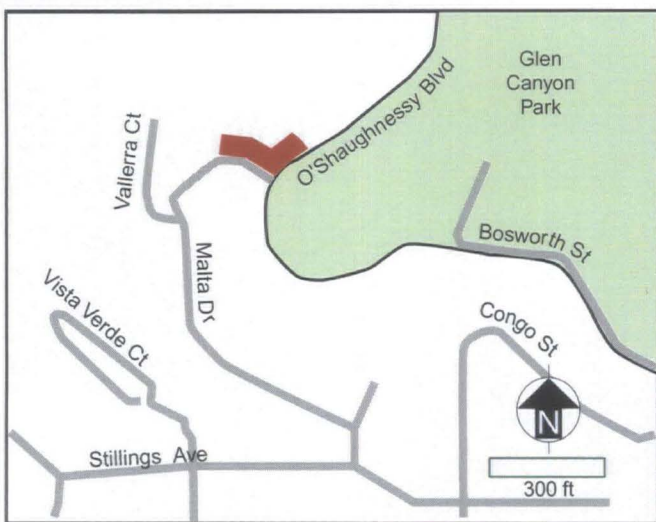
Metals Concentrations in Franciscan Bedrock Outcrops



Twin Peaks Boulevard



Malta and O'Shaughnessy Streets



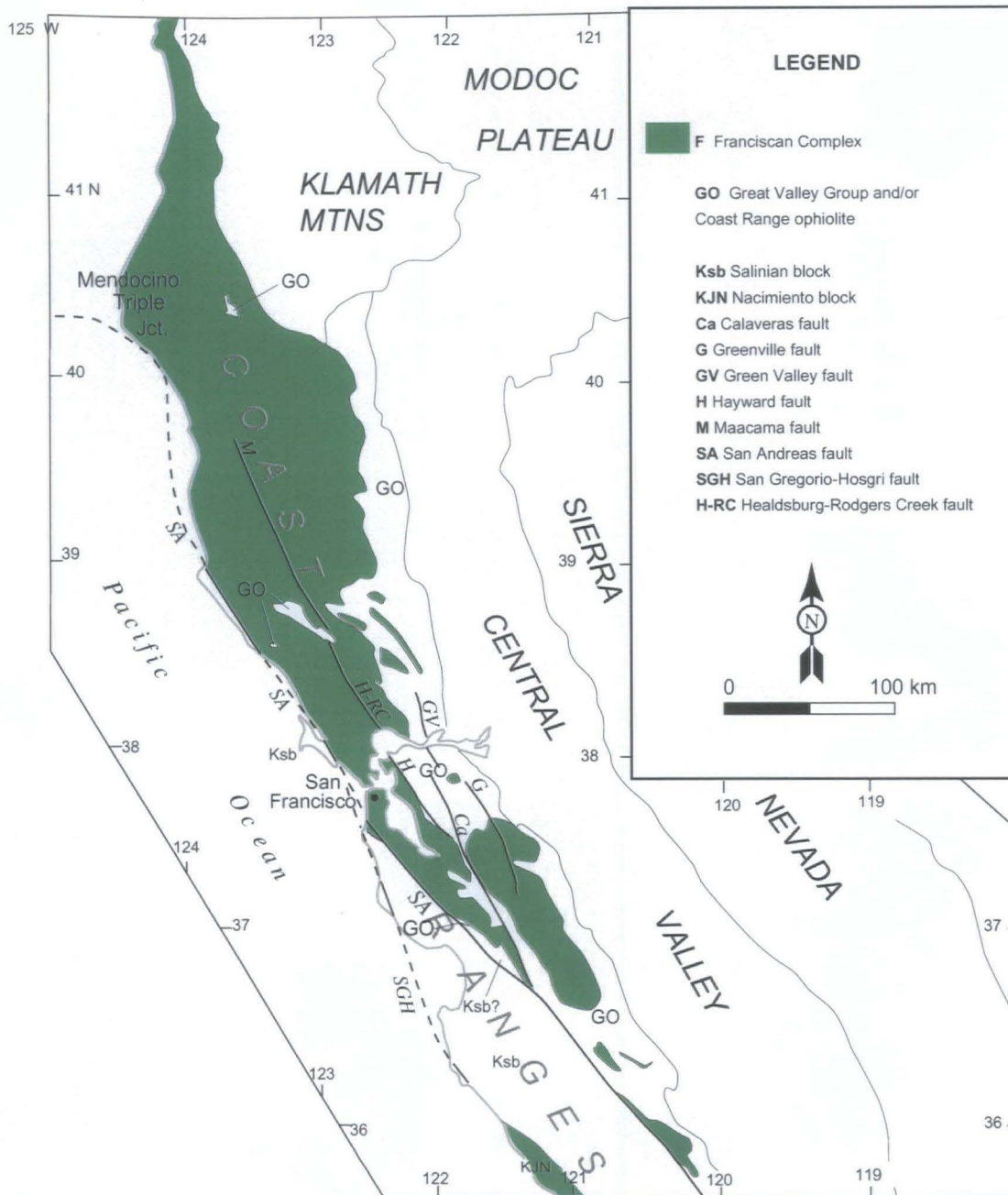
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Hunters Point Shipyard, San Francisco, California
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 2

STREET MAPS OF THE STUDY SITES

Metals Concentrations in Franciscan Bedrock Outcrops

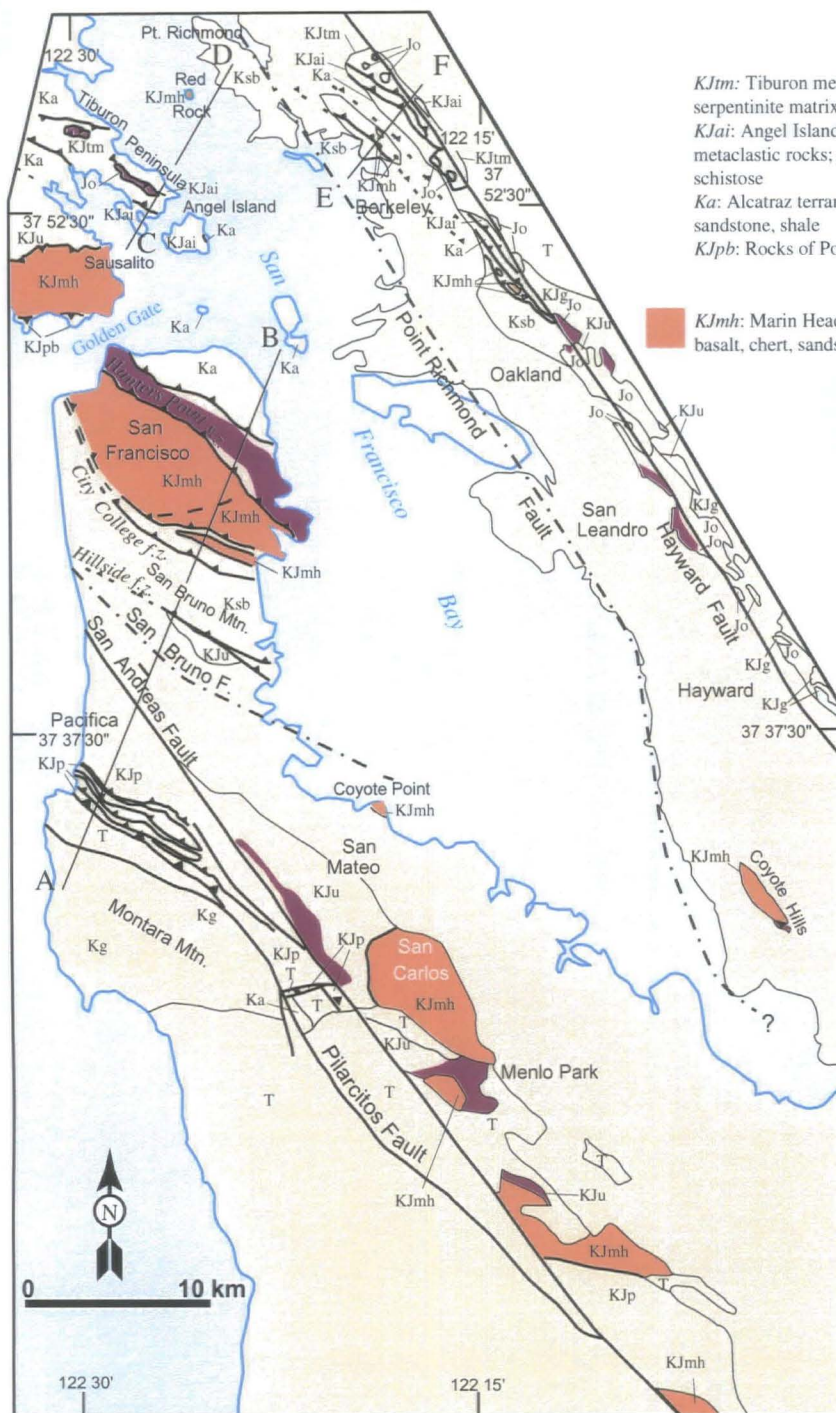


Note that the Nacimiento Block or Sur Terrane is shown in the same color as the Franciscan. These rocks were once considered part of the Franciscan and are essentially identical in age, structure, and rock types. The Sur Terrane extends to south of Santa Barbara (south of southern border of this figure).
Modified from Wakabayashi 1999a.

Tt Tetra Tech EM Inc.

Hunters Point Shipyard, San Francisco, California
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 3
DISTRIBUTION OF FRANCISCAN BEDROCK
IN CENTRAL AND
NORTHERN CALIFORNIA
Metals Concentrations in Franciscan Bedrock Outcrops



EXPLANATION

Franciscan Units

KJtm: Tiburon melange: shale and serpentinite matrix melange
KJai: Angel Island nappe; metavolcanic, metaclastic rocks; incipiently foliated to schistose
Ka: Alcatraz terrane (nappe): arkosic sandstone, shale
KJpb: Rocks of Point Bonita: basalt

Ksb: San Bruno Mtn. nappe (San Bruno Mtn., Novato Quarry terranes): K-feldspar-bearing arkosic sandstone, shale
KJp: Permanente terrane: basalt, sandstone, shale, limestone, chert
Hunters Point Shear Zone, City College Fault Zone, Hillside Fault Zone: melange zones bounding coherent nappes; shale matrix melange with a large body of serpentinite associated with the Hunters Point Shear Zone
KJu: undifferentiated Franciscan

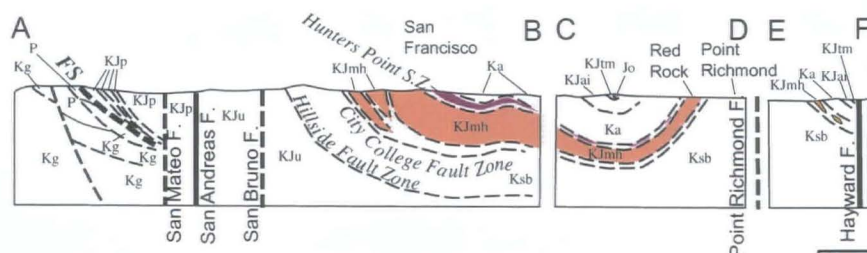
KJmh: Marin Headlands terrane (nappe): basalt, chert, sandstone, shale.

Non-Franciscan Units

Jo: Coast Range ophiolite and related rocks
KJg: Sandstones and shales of the Great Valley Group
Kg: Plutonic rocks of the Salinian block
Ka: Upper Cretaceous, conglomerate, sandstone, shale correlative to rocks at Anchor Bay
T: Tertiary rocks undifferentiated

General

Serpentinite: Coast Range ophiolite or Franciscan affinity as designated



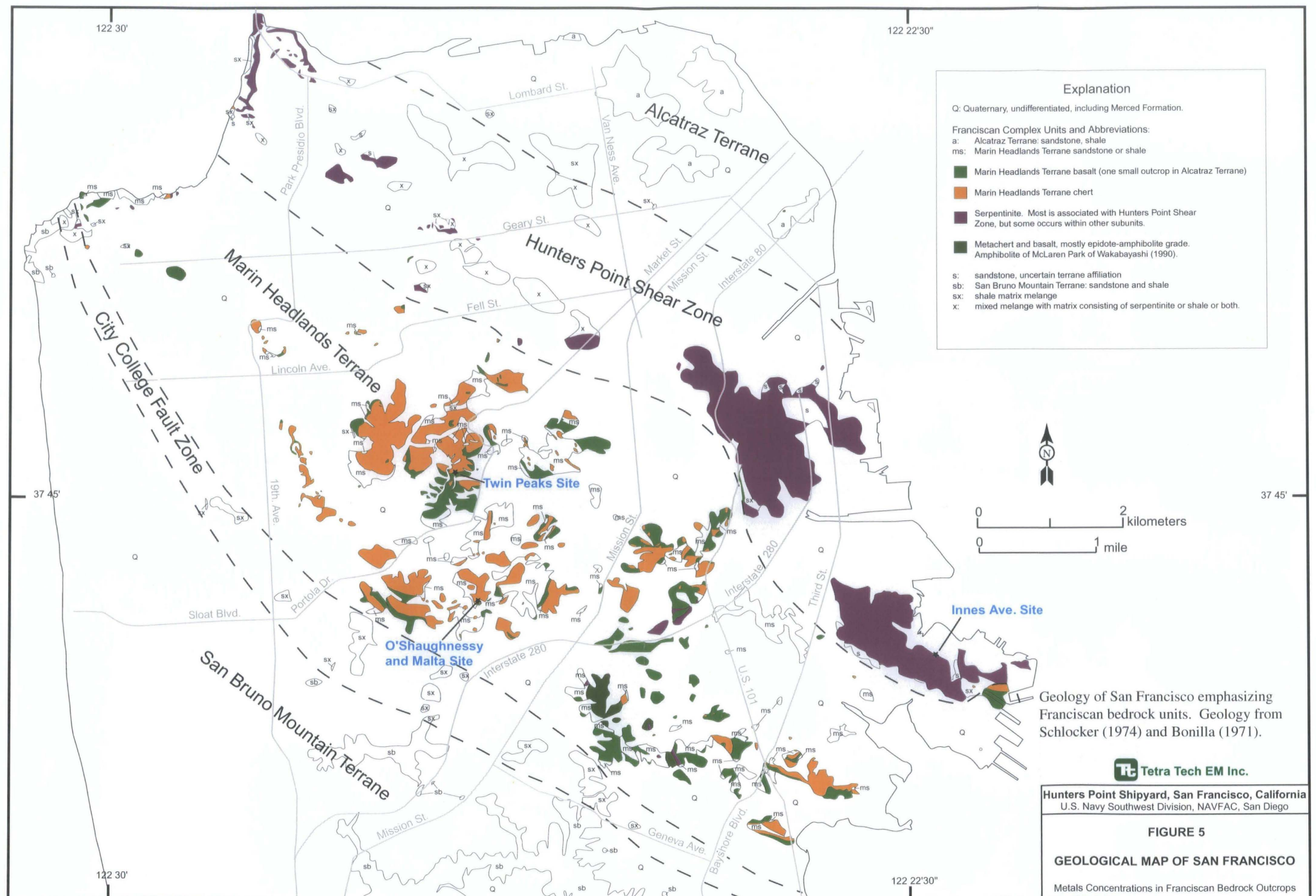
Geologic map showing distribution of Franciscan and other rock units within the San Francisco Bay area. Modified from Wakabayashi (1999b).

Tetra Tech EM Inc.

Hunters Point Shipyard, San Francisco, California
 U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 4

DISTRIBUTION OF FRANCISCAN ROCKS IN THE SAN FRANCISCO BAY AREA
 Metals Concentrations in Franciscan Bedrock Outcrops



Geology of San Francisco emphasizing Franciscan bedrock units. Geology from Schlocker (1974) and Bonilla (1971).

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Hunters Point Shipyard, San Francisco, California
U.S. Navy Southwest Division, NAVFAC, San Diego

FIGURE 5

GEOLOGICAL MAP OF SAN FRANCISCO

Metals Concentrations in Franciscan Bedrock Outcrops

APPENDIX A
RESULTS OF REGIONAL BEDROCK SITES AMBIENT METALS SAMPLING



Shaw Environmental, Inc.
4005 Port Chicago Highway
Concord, CA 94521
Phone: 925.288.9898
Fax: 925.288.0888

September 4, 2003

DCN: NAV001-016-H

Mr. Chon Son, Code 06CH.CS
ACO Regional Environmental Contracts
U.S. Department of the Navy, Southwest Division
1230 Columbia Street, 8th Floor
San Diego, California 92132-5190

Attn: Mr. Patrick Brooks, R.G., Code 06CH.GB

**Subject: Results of Regional Bedrock Sites Ambient Metals Sampling for
Hunters Point Shipyard, San Francisco, California
Contract Number N68711-01-D-6011, Contract Task Order 0001**

Dear Mr. Brooks:

Ninety-one rock and soil samples plus quality control samples were collected as part of the Regional Bedrock Sites Ambient Metals Evaluation, Hunters Point Shipyard (HPS), San Francisco, California. Activities performed in support of rock and soil sampling were executed under Environmental Multiple Award Contract Number N68711-01-D-6011, Contractor Task Order 0001, Task 3a in accordance with the Field Sampling Plan and Quality Assurance Project Plan (FSP/QAPP) for Regional Bedrock Sites Ambient Metals Evaluation prepared by the CLEAN Contractor, Tetra Tech, EM, Inc (TtEMI). Initial screening of the bedrock sites, that resulted in the selection of three bedrock sites cited in the work plan, was conducted on January 15, 2003 with the Navy; TtEMI, John Wakabayashi, PhD, R.G., a consulting geologist; and Shaw Environmental, Inc. (Shaw). Sampling occurred on April 22, May 19, and June 10, 2003 at the three rock outcrop areas: Innes Avenue (Innes), Malta Drive and O'Shaughnessy Boulevard (Malta and O'Shaughnessy) and Twin Peaks Boulevard (Twin Peaks). The Twin Peaks location substituted for the site at 22nd Street and Wisconsin Street (22nd and Wisconsin) site described in the FSP/QAPP due to lack of access to the 22nd and Wisconsin Street site for sampling. The locations of the rock outcrop areas are presented on Figures 1 and 2.

Pre-Construction Field Activities

Guidance for conducting the planned fieldwork was presented in a field work variance (FWV) to the FSP/QAPP. FWV 843812-001R1 (dated May 29, 2003) included a figure of proposed sample locations; a table of data quality objectives; a table of proposed planned samples and analyses; copies of relevant standard operating procedures; a Contractor Quality Control Plan; and a Health and Safety Activity Hazard Analysis. A preparatory meeting was held on April 21, 2003 prior to the start of fieldwork to discuss the definable features work. This meeting was scheduled with the Navy Resident Officer In Charge of Construction (ROICC). The definable features of work discussed at the meeting were:

- Sample Location Selection;
- Decontamination;
- Sample Collection, Handling, and Shipment; and
- Sample Analyses;

- Analytical Quality Control;
- Data Management; and
- Data Validation.

The ROICC and the RPM participated in the meeting, along with the field staff responsible for the fieldwork. Communication with the ROICC occurred on a regular basis, however, the ROICC did not accompany the field team during the sampling event. A Temporary Minor Encroachment Permit was required for the Malta and O'Shaughnessy and Twin Peaks sites because these two sites are located on City of San Francisco Recreation and Park Department property. The initial permit was issued on May 12, 2003 for the Malta and O'Shaughnessy site. An addendum to the initial permit was issued on June 6, 2003 for the Twin Peaks site (see Attachment 1).

Grid Layout and Sample Collection

Prior to each field effort, a set of random numbers were generated and applied to grids for use in the field. An order of magnitude greater number of grids verses sample locations were selected for random number generation. When in the field, grids were laid out using either nails or flagging with colored surveyors' twine to create the outside of the grid. Each sample point was measured based on the distance from the lower left hand corner of the grid. Based on results of random number generation, a typical grid consisted of 150 grid cells from which 15 rock or soil samples were collected. At each location, two grids were laid out, one for rock and the other for soil, to collect random samples. Sample grids for the Innes Avenue (RBS01), Twin Peaks (RBS02), and the Malta and O'Shaughnessy (RBS03) sites are presented on Figures 3, 4, and 5, respectively.

Rock and Soil Sample Collection and Analysis

Upon location of the sample grid cell, rock or soil was collected using a pre-cleaned rock hammer or stainless steel sample trowel. Rock and soil samples were placed into new, pre-cleaned eight ounce jars with Teflon-lined lids. The pre-cleaned jars were obtained from the analytical laboratory, Applied P & Ch Laboratory (APCL) in Chino, California. The labeled and filled jars were placed into pre-cooled ice chests for temporary storage pending inventory and shipment to the laboratory. During the inventory process, jar labels were inspected for agreement with the chain of custody documentation. Each jar was wrapped in a bubble wrap envelope and placed in a Ziploc® bag. The bagged sample jars were replaced into pre-cooled ice chests and shipped to the laboratory via overnight courier.

The samples were analyzed by APCL, of Chino, California, using U.S. Environmental Protection Agency (EPA) Method 6010 and 7471 (for total mercury); and EPA Method 9030B for soluble acid sulfides. The results of the metals and soluble acid sulfide analyses of the rock and soil samples are summarized on Tables 1, 2, and 3. The complete analytical reports from the lab are presented in Attachment 2. Data validation information is summarized in Attachment 3.

Rock/Soil Sample Location Land Survey

Land survey measurements in X and Y coordinates were collected using Global Positioning Survey (GPS). At the completion of each sampling event, the grids were surveyed using a Trimble ProXRS with an average accuracy of 1.5 feet. The surveyed points are presented on Figures 6, 7, and 8 for sites RBS01, RBS02, and RBS03, respectively. Two of the sites (Innes, and Malta and O'Shaughnessy) had reference survey markers in the street. The Twin Peaks site did not have reference marks due to the distance of the site from the street or any known benchmarks. GPS survey data is provided in Attachment 4.

Post-Construction Field Activities

At the conclusion of each field effort, draft laboratory data, maps of soil and rock samples and photo logs were transmitted to the RPM and CLEAN contractor for preliminary use in conducting a draft risk analysis.

Each site was restored by removal of grid flagging, nails, and surveyor's string, and any open soil borings were backfilled in accordance with the encroachment permit.

Closing

This concludes the events for Task 3a of the EMAC Contract CTO 0001. If you have any comments or questions, please contact Wayne Akiyama at (925) 288-2003.

Sincerely,



Wayne S. Akiyama, R.G. #6009
Task Manager



Dennis M. Robinson, Dr. Env., CIH
Sr. Project Manager

Enclosures

cc:	<u>Shaw</u>	<u>Navy</u>	<u>Other</u>
	Michael Reed	Pat Brooks	Tom Shoff, TtEMI
	EMAC Project Files	Glenn Christensen	Arnab Chakrabarti, TtEMI

Tables

1. Innes Avenue Site - RBS01 Data Summary
2. Twin Peaks Site - RBS02 Data Summary
3. Malta Drive and O'Shaughnessy Blvd Site - RBS03 Data Summary

Figures

1. Site Vicinity Map (Prepared by TtEM, Inc.)
2. Location of Regional Bedrock Sites (Prepared by TtEM, Inc.)
3. RBS01 Random Number Grid, Innes Avenue
4. RBS02 Random Number Grid, Twin Peaks Boulevard
5. RBS03 Random Number Grid, Malta Drive and O'Shaughnessy Boulevard
6. Map of Soil and Rock Sample Locations, Innes Avenue, SF, CA
7. Map of Soil and Rock Sample Locations, Twin Peaks Blvd, SF, CA
8. Map of Soil and Rock Sample Locations, Malta and O'Shaughnessy

Attachments

1. Temporary Encroachment Permit and Addendum
2. Environmental Sample Analytical Laboratory Reports with Chain of Custody Records
3. Data Quality Assessment Report
4. GPS Survey Data
5. References

TABLES

**Table 1: Summary of Results
Innes Avenue - RBS01 Data Summary**

Analytical Method:					9030	6010/7471A																							
Cell Location	Sample Location	Sample Date	Sample Depth	Sample Type	Sulfide (Acid Soluble)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
Innes Avenue - Rock Sample Results																													
6	RBS01SP01	04/22/03	0-0.2	NS	100 UJ	1,430	10 U	0.8 J	1.3 J	0.5 U	0.5 U	61.8 J	614.0	85.1 J	4.6 J	45,900 J	1 UJ	210,000	547.0	0.2 U	5 U	1,710 J	74.1 J	5 UJ	5 U	5000 UJ	2.7 J	13.3	20.5
9	RBS01SP02	04/22/03	0-0.2	NS	100 UJ	1,540	10 U	1.0 J	3.4 J	0.5 U	0.5 U	157.0	642.0	78.9 J	5.3	40,700 J	3.6 J	198,000	531.0	0.2 U	5 U	1,620 J	89.0 J	5 UJ	5 U	5000 UJ	2.1 J	14.9	23.7
25	RBS01SP03	04/22/03	0-0.2	NS1	100 UJ	1,560	10 U	0.8 J	3.4 J	0.5 U	0.5 U	144.0	571.0	86.1 J	5 U	45,600 J	7.9 J	196,000	666.0	0.2 U	5 U	1,550 J	100.0 J	5 UJ	5 U	5000 UJ	2.9 J	15.5	32.5
25	RBS01SP04	04/22/03	0-0.2	FD	100 UJ	1,800	10 U	1.1 J	7.6 J	0.5 U	0.5 U	419.0	516.0	77.0 J	13.1	40,700 J	31.7 J	172,000	826.0	0.1 J	5 U	1,190 J	155.0 J	5 UJ	5 U	106.0 J	2.7 J	15.6	51.7
148	RBS01SP05	04/22/03	0-0.2	NS	100 UJ	2,100	10 U	0.9 J	2.1 J	0.5 U	0.5 U	84.3 J	332.0	74.5 J	6.3	41,800 J	5.3 J	192,000	584.0	0.2 U	5 U	1,260 J	81.0 J	5 UJ	5 U	5000 UJ	3.0 J	13.7	22.3
138	RBS01SP06	04/22/03	0-0.2	NS	100 UJ	861.0	10 U	0.8 J	5.9 J	0.5 U	0.5 U	153.0	192.0	86.3 J	9.9	45,400 J	14.5 J	191,000	630.0	0.1 J	5 U	1,690 J	114.0 J	5 UJ	5 U	5000 UJ	2.3 J	6.3	30.8
131	RBS01SP07	04/22/03	0-0.2	NS	100 UJ	1,280	10 U	0.8 J	7.5 J	0.5 U	0.5 U	180.0	72.9	34.3 J	4.6 J	22,600 J	16.1 J	165,000	614.0	0.2 U	5 U	499.0 J	115.0 J	5 UJ	5 U	5000 UJ	2.7 J	5.0 J	32.4
91	RBS01SP08	04/22/03	0-0.2	NS	100 UJ	1,460	10 U	0.7 J	4.5 J	0.5 U	0.5 U	56.5 J	645.0	83.5 J	7.3	42,500 J	11.2 J	196,000	506.0	0.2 U	5 U	1,520 J	98.6 J	5 UJ	5 U	5000 UJ	2.6 J	13.8	26.7
42	RBS01SP09	04/22/03	0-0.2	NS	100 UJ	1,230	10 U	1.0 J	5.7 J	0.5 U	0.5 U	43.2 J	424.0	82.2 J	8.2	38,900 J	10.9 J	184,000	626.0	0.2 U	5 U	1,560 J	109.0 J	5 UJ	5 U	5000 UJ	3.0 J	11.2	30.3
49	RBS01SP10	04/22/03	0-0.2	NS	100 UJ	1,250	10 U	1.0 J	5.3 J	0.5 U	0.5 U	91.4 J	483.0	78.0 J	6.1	42,200 J	14.4 J	181,000	598.0	0.2 U	5 U	1,570 J	94.5 J	5 UJ	5 U	5000 UJ	2.5 J	13.5	34.6
53	RBS01SP11	04/22/03	0-0.2	NS	100 UJ	1,130	10 U	1.5 J	3.1 J	0.5 U	0.5 U	200.0	433.0	82.1 J	3.8 J	43,000 J	7.8 J	186,000	597.0	0.2 U	5 U	1,500 J	91.6 J	5 UJ	5 U	5000 UJ	2.2 J	13.1	27.5
86	RBS01SP13	04/22/03	0-0.2	FD	100 UJ	917.0	10 U	1.2 J	0.9 J	0.5 U	0.5 U	100 U	331.0	86.7 J	5 U	48,100 J	0.2 J	201,000	680.0	0.2 U	5 U	1,910 J	64.1 J	5 UJ	5 U	5000 UJ	2.7 J	10.6	20.6
86	RBS01SP12	04/22/03	0-0.2	NS1	100 UJ	689.0	10 U	10 U	1.0 J	0.5 U	0.5 U	109.0	265.0	97.4 J	5 U	41,000 J	0.2 J	175,000	671.0	0.1 J	5 U	1,810 J	67.1 J	5 UJ	5 U	5000 UJ	3.0 J	8.5	21.1
76	RBS01SP14	04/22/03	0-0.2	NS	100 UJ	1,280	10 U	1.4 J	11.4	0.5 U	0.5 U	197.0	280.0	70.4 J	16.6	39,100 J	36.1 J	174,000	618.0	0.2 U	5 U	1,340 J	137.0 J	5 UJ	5 U	5000 UJ	2.3 J	9.7	50.9
63	RBS01SP15	04/22/03	0-0.2	NS	100 UJ	742.0	10 U	10 U	5.0 J	0.5 U	0.5 U	984.0	134.0	89.7 J	11.1	45,100 J	5.2 J	179,000	686.0	0.1 J	5 U	1,570 J	174.0 J	5 UJ	5 U	5000 UJ	2.6 J	4.0 J	24.6
105	RBS01SP16	04/22/03	0-0.2	NS	100 UJ	850.0	10 U	1.2 J	4.0 J	0.5 U	0.5 U	87.4 J	223.0	71.9 J	7.2	39,600 J	5.5 J	187,000	522.0	0.2 U	5 U	1,430 J	111.0 J	5 UJ	5 U	5000 UJ	2.7 J	6.1	25.2
109	RBS01SP17	04/22/03	0-0.2	NS	100 UJ	743.0	10 U	1.3 J	3.6 J	0.5 U	0.5 U	51.5 J	307.0	77.0 J	4.7 J	40,500 J	1.7 J	175,000	655.0	0.2 U	5 U	1,650 J	68.6 J	5 UJ	5 U	5000 UJ	2.5 J	6.7	20.2
145	RBS01SP26	04/22/03	0.17-0.5	NS	100 UJ	1,460 J	10 U	1.1 J	1.8 J	0.5 U	0.5 U	200.0 J	509.0 J	82.6 J	5.3	32,900 J	1.2 J	153,000	522.0 J	0.2 U	5 U	1,700 J	72.1 J	5 UJ	5 U	5000 UJ	1.6 J	15.6 J	25.0
Innes Avenue - Soil Sample Results																													
4	RBS01SS21	04/22/03	0.17-0.5	NS1	120 UJ	4,850 J	12 U	2.6 J	33.3 J	0.61 U	0.61 U	1,660 J	642.0 J	99.8 J	24.7	58,800 J	69.8 J	117,000	903.0 J	0.3	6.1 U	1,780 J	514.0 J	6.1 U	6.1 U	610 U	12 UJ	27.8 J	87.4
4	RBS01SS22	04/22/03	0.17-0.5	FD	130 UJ	5,940 J	13 U	2.9 J	37.0 J	0.67 U	0.67 U	2,450 J	646.0 J	106.0 J	28.0	62,300 J	84.9 J	123,000	992.0 J	0.3 J	6.7 U	1,900 J	546.0 J	2.2 J	6.7 U	670 U	1.2 J	31.1 J	104.0
8	RBS01SS23	04/22/03	0.17-0.5	NS	120 UJ	3,120 J	12 U	2.3 J	21.8 J	0.6 U	0.6 U	945.0 J	420.0 J	92.0 J	14.1	52,100 J	34.4 J	158,000	1,070 J	0.1 J	6 U	1,520 J	600 UJ	6 U	6 U	600 U	1.5 J	25.2 J	50.2
9	RBS01SS24	04/22/03	0.17-0.5	NS	120 UJ	2,770 J	12 U	1.5 J	15.6 J	0.59 U	0.59 U	606.0 J	548.0 J	96.6 J	9.4	50,500 J	13.8 J	174,000	995.0 J	0.1 J	5.9 U	1,690 J	590 UJ	1.9 J	5.9 U	85.7 J	1.8 J	28.8 J	37.3
28	RBS01SS25	04/22/03	0.17-0.5	NS	130 UJ	9,180 J	13 U	3.7 J	63.6 J	0.65 U	0.65 U	4,240 J	744.0 J	116.0 J	37.0	67,500 J	111.0 J	97,800	1,230 J	0.2 J	6.5 U	1,610 J	871.0 J	3.3 J	6.5 U	650 U	13 UJ	43.6 J	123.0
144	RBS01SS27	04/22/03	0.17-0.5	NS	140 UJ	7,840 J	14 U	3.3 J	62.5 J	0.72 U	0.72 U	1,820 J	690.0 J	131.0 J	21.4	61,500 J	33.8 J	155,000	3,130 J	0.3 J	7.2 U	2,120 J	586.0 J	3.3 J	7.2 U	720 U	0.9 J	30.0 J	60.3
38	RBS01SS28	04/22/03	0.17-0.5	NS	120 UJ	2,930 J	12 U	1.9 J	20.8 J	0.59 U	0.59 U	958.0 J	484.0 J	104.0 J	16.1	45,700 J	28.3 J	157,000	987.0 J	0.1 J	5.9 U	1,570 J	590 UJ	2.2 J	5.9 U	590 U	1.2 J	25.9 J	52.0
68	RBS01SS29	04/22/03	0.17-0.5	NS	130 UJ	4,190 J	13 U	2.0 J	31.4 J	0.65 U	0.65 U	1,450 J	540.0 J	108.0 J	23.0	56,900 J	66.5 J	147,000	953.0 J	0.2 J	6.5 U	1,840 J	450.0 J	2.1 J	6.5 U	650 U	13 UJ	27.9 J	84.0
69	RBS01SS30	04/22/03	0.17-0.5	NS	120 UJ	3,530 J	12 U	2.0 J	26.7 J	0.61 U	0.61 U	1,170 J	533.0 J	93.2 J	18.4	51,300 J	38.3 J	142,000	812.0 J	0.1 J	6.1 U	1,670 J	619.0 J	1.9 J	6.1 U	610 U	0.8 J	26.5 J	68.9
99	RBS01SS31	04/22/03	0.17-0.5	NS	130 UJ	5,680 J	13 U	3.0 J	48.5 J	0.67 U	0.67 U	2,340 J	618.0 J	110.0 J	33.8	61,500 J	125.0 J	116,000	1,050 J	0.2 J	6.7 U	1,820 J	730.0 J	3.3 J	6.7 U	670 U	13 UJ	30.8 J	122.0
103	RBS01SS32	04/22/03	0.17-0.5	NS	120 UJ	3,370 J	12 U	2.3 J	13.4 J	0.6 U	0.6 U	861.0 J	752.0 J	83.3 J	11.5	42,400 J	23.0 J	170,000	842.0 J	0.1 J	6 U	1,460 J	600 UJ	1.9 J	6 U	600 U	1.7 J	33.7 J	37.8
105	RBS01SS33	04/22/03	0.17-0.5	NS	130 UJ	6,660 J	13 U	2.8 J	41.6 J	0.63 U	0.63 U	3,500 J	592.0 J	96.2 J	26.7	56,300 J	75.5 J	133,000	1,080 J	0.6	6.3 U	1,610 J	614.0 J	6.3 U	6.3 U	630 U	13 UJ	34.3 J	95.3
50	RBS01SS34	04/22/03	0.17-0.5	NS	130 UJ	7,350 J	13 U	3.0 J	54.0 J	0.66 U	0.66 U	3,260 J	675.0 J	117.0 J	31.6	66,300 J	95.0 J	116,000	1,170 J	0.4	6.6 U	1,720 J	796.0 J	2.2 J	6.6 U	660 U	13 UJ	35.9 J	113.0
78	RBS01SS35	04/22/03	0.17-0.5	NS	130 UJ	7,750 J	13 U	2.9 J	56.8 J	0.67 U	0.67 U	3,650 J	678.0 J	122.0 J	33.6	66,300 J	110.0 J	95,200	1,190 J	0.5	6.7 U	1,810 J	899.0 J	2.5 J	6.7 U	670 U	13 UJ	37.4 J	115.0
86	RBS01SS36	04/22/03	0.17-0.5	NS	140 UJ	8,500 J	14 U	2.4 J	63.6 J	0.68 U	0.68 U	3,790 J	712.0 J	120.0 J	36.8	71,100 J	115.0 J	116,000	1,280 J	0.3 J	6.8 U	1,620 J	870.0 J	2.3 J	6.8 U	680 U	14 UJ	40.4 J	124.0

1. Sample RBS01SP26 was collected within the soil grid.

SP - serpentinite

SS - soil sample

NS - Normal sample

NS1 - normal sample where a field duplicate was also collected

FD - field duplicate

J - estimated value

U - non detect at the practical quantitation limit

Table 2: Summary of Results
Twin Peaks - RBS02 Data Summary

Analytical Method:					9030	6010/7471A																							
Cell Location	Sample Location	Sample Date	Sample Depth	Sample Type	Sulfide (Acid Soluble)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
Twin Peaks - Rock Sample Results																													
112	RBS02CH112-213	06/10/03	0-0.5	NS	100 UJ	6,200	40 U	22.3 J	2,280 J	2 U	0.3 J	1,060 J	8.9 J	14.5 J	215.0	63,300	38.4	1,030	23,500	0.1 J	20 U	130.0	710.0 J	14.9 J	0.5 J	2000 UJ	40 U	44.2	169.0
118	RBS02CH118-215	06/10/03	0-0.5	NS	100 UJ	4,280	40 U	11.6 J	925.0 J	2 U	2 UJ	556.0 J	8.9 J	10.8 J	115.0	29,400	21.1	516.0	13,700	0.0 J	20 U	97.5	323.0 J	10.0 J	0.4 J	2000 UJ	1.5 J	20.5	110.0
12	RBS02CH12-205	06/10/03	0-0.5	NS	100 UJ	8,740	40 U	33.8 J	1,610 J	2 U	0.7 J	585.0 J	14.8 J	20.7	194.0	66,300	43.1	1,210	14,500	0.1 J	20 U	63.4	1,130 J	10.7 J	20 U	2000 UJ	40 U	45.8	97.8
128	RBS02CH128-204	06/10/03	0-0.5	NS	100 UJ	2,860	40 U	12.1 J	755.0 J	0.1 J	0.3 J	657.0 J	3.1 J	5.4 J	89.9	10,200	8.8	553.0	7,980	0.1 J	20 U	43.0	178.0 J	5.8 J	0.5 J	2000 UJ	1.0 J	26.6	76.4
145	RBS02CH145-214	06/10/03	0-0.5	NS	100 UJ	2,010	40 U	7.6 J	658.0 J	2 U	2 UJ	423.0 J	10.3 J	4.4 J	188.0	15,100	17.9	1,090	7,800	0.1 J	1.4 J	67.3	135.0 J	5.6 J	0.4 J	2000 UJ	1.1 J	14.9 J	67.0
16	RBS02CH16-207	06/10/03	0-0.5	NS	100 UJ	3,210	40 U	10.8 J	1,540 J	0.4 J	0.2 J	297.0 J	12.9 J	11.7 J	137.0	15,100	12.8	527.0	14,300	0.0 J	0.8 J	81.5	179.0 J	9.4 J	0.7 J	2000 UJ	2.3 J	36.7	116.0
22	RBS02CH22-210	06/10/03	0-0.5	NS1	100 UJ	7,210	40 U	16.7 J	943.0 J	2 U	2 UJ	531.0 J	7.8 J	31.0	180.0	60,700	51.8	1,150	15,800	0.1 J	20 U	99.3	590.0 J	10.3 J	0.4 J	2000 UJ	40 U	30.7	123.0
22	RBS02CH150-211	06/10/03	0-0.5	FD	100 UJ	5,820	40 U	12.5 J	880.0 J	2 U	2 UJ	542.0 J	10.3 J	22.1	165.0	47,700	32.3	2,390	12,900	0.0 J	20 U	111.0	496.0 J	8.5 J	0.5 J	2000 UJ	0.7 J	27.0	112.0
42	RBS02CH42-206	06/10/03	0-0.5	NS	100 UJ	15,000	40 U	37.9 J	4,390 J	2 U	0.6 J	889.0 J	16.8 J	34.8	336.0	107,000	77.3	2,390	40,500	0.1 J	20 U	143.0	2,290	23.3 J	1.6 J	2000 UJ	1.4 J	54.2	267.0
46	RBS02CH46-208	06/10/03	0-0.5	NS	100 UJ	4,440	40 U	11.1 J	1,860 J	2 U	2 UJ	298.0 J	5.2 J	14.6 J	197.0	20,700	19.5	752.0	16,200	0.0 J	20 U	60.5	340.0 J	10.5 J	0.9 J	2000 UJ	1.9 J	18.4 J	93.6
53	RBS02CH53-212	06/10/03	0-0.5	NS	100 UJ	8,720	40 U	15.8 J	1,230 J	2 U	0.2 J	706.0 J	10.3 J	26.9	207.0	81,500	48.2	1,400	18,700	0.1 J	20 U	114.0	1,020 J	13.7 J	0.4 J	2000 UJ	1.3 J	42.2	142.0
60	RBS02CH60-216	06/10/03	0-0.5	NS	100 UJ	6,780	40 U	29.4 J	931.0 J	2 U	0.3 J	1,000 J	12.2 J	17.8 J	111.0	59,300	36.8	948.0	11,900	0.1 J	20 U	76.6	672.0 J	8.0 J	0.2 J	2000 UJ	40 U	31.5	70.6
66	RBS02CH100-203	06/10/03	0-0.5	FD	100 UJ	6,710	40 U	21.9 J	1,810 J	2 U	0.4 J	344.0 J	12.5 J	24.0	295.0	61,300	47.3	810.0	19,900	0.1 J	20 U	114.0	647.0 J	12.0 J	0.4 J	2000 UJ	1.4 J	34.8	169.0
66	RBS02CH66-202	06/10/03	0-0.5	NS1	100 UJ	4,940	40 U	18.8 J	1,220 J	2 U	0.4 J	279.0 J	7.7 J	18.7 J	212.0	54,300	33.6	782.0	14,300	0.0 J	20 U	85.1	663.0 J	9.4 J	0.3 J	2000 UJ	40 U	28.6	127.0
79	RBS02CH79-209	06/10/03	0-0.5	NS	100 UJ	4,340	40 U	22.9 J	908.0 J	2 U	0.3 J	334.0 J	6.0 J	19.5 J	131.0	45,600	31.7	716.0	11,100	0.0 J	20 U	55.9	539.0 J	6.8 J	20 U	2000 UJ	40 U	24.3	79.1
92	RBS02CH92-200	06/10/03	0-0.5	NS	100 UJ	9,820	40 U	31.8 J	2,630 J	2 U	0.4 J	586.0 J	11.6 J	42.7	333.0	71,200	54.0	1,460	19,200	0.0 J	20 U	118.0	1,060 J	10.4 J	20 U	2000 UJ	1.0 J	37.4	150.0
95	RBS02CH95-201	06/10/03	0-0.5	NS	100 UJ	7,930	40 U	22.8 J	2,520 J	2 U	0.4 J	558.0 J	8.0 J	22.1	201.0	75,000	48.1	1,350	22,200	0.0 J	20 U	87.6	823.0 J	12.1 J	0.5 J	2000 UJ	40 U	43.3	182.0
Twin Peaks - Soil Sample Results																													
05	RBS02SS100-218	06/10/03	0.5-1	FD	110 UJ	16,300	45 U	4.0 J	205.0	2.2 U	2.2 U	1,500 J	47.1	9.5 J	40.8	37,000	43.0	2,080	531.0	0.1 J	22 U	16.0 J	2,530 J	1.4 J	22 U	2200 UJ	45 U	65.7	47.9
05	RBS02SS05-217	06/10/03	0.5-1	NS1	110 UJ	18,800	45 U	5.7 J	233.0	2.2 U	2.2 U	1,710 J	51.5	10.9 J	46.1	40,900	52.5	2,360	640.0	0.1 J	0.5 J	18.8 J	3,080 J	1.8 J	22 U	2200 UJ	45 U	75.3	54.3
10	RBS02SS10-222	06/10/03	0.5-1	NS	110 UJ	19,400	45 U	4.9 J	293.0	2.2 U	2.2 U	1,820 J	56.5	11.7 J	48.8	46,200	38.4	2,460	701.0	0.1 J	0.4 J	21.2 J	3,030 J	1.1 J	22 U	2200 UJ	45 U	80.5	57.5
118	RBS02SS118-231	06/10/03	0.5-1	NS	110 UJ	18,800	45 U	4.8 J	428.0	2.3 U	2.3 U	1,670 J	51.4	12.0 J	44.4	43,900	25.8	2,360	703.0	0.1 J	23 U	19.2 J	2,790 J	23 U	23 U	2300 UJ	45 U	77.4	49.8
120	RBS02SS120-232	06/10/03	0.5-1	NS	110 UJ	17,400	45 U	4.6 J	394.0	2.2 U	2.2 U	1,610 J	49.9	11.6 J	46.0	40,400	50.6	2,320	757.0	0.1 J	22 U	18.1 J	2,760 J	1.4 J	22 U	2200 UJ	45 U	73.3	52.5
129	RBS02SS129-221	06/10/03	0.5-1	NS	110 UJ	18,600	45 U	5.5 J	380.0	2.2 U	2.2 U	1,730 J	53.0	11.2 J	47.3	42,800	45.8	2,360	649.0	0.1 J	0.5 J	18.2 J	2,880 J	1.0 J	22 U	2200 UJ	45 U	75.9	54.1
143	RBS02SS143-226	06/10/03	0.5-1	NS	110 UJ	19,800	44 U	4.9 J	363.0	2.2 U	2.2 U	1,820 J	56.3	12.9 J	49.5	47,000	38.0	2,570	835.0	0.1 J	22 U	20.2 J	3,090 J	1.1 J	22 U	2200 UJ	44 U	83.8	57.6
150	RBS02SS150-233	06/10/03	0.5-1	NS	110 UJ	21,400	44 U	4.4 J	535.0	2.2 U	2.2 U	1,480 J	54.6	12.5 J	51.7	49,500	28.4	2,530	642.0	0.1 J	22 U	20.1 J	3,060 J	1.0 J	22 U	2200 UJ	44 U	84.8	46.4
26	RBS02SS26-227	06/10/03	0.5-1	NS	110 UJ	18,000	44 U	5.1 J	385.0	2.2 U	2.2 U	1,430 J	47.5	12.5 J	47.6	43,500	36.0	2,130	815.0	0.1 J	22 U	17.9 J	2,620 J	22 U	22 U	2200 UJ	44 U	73.4	48.1
35	RBS02SS35-219	06/10/03	0.5-1	NS	110 UJ	17,700	46 U	5.9 J	234.0	2.3 U	2.3 U	1,870 J	52.9	11.9 J	48.0	42,100	71.8	2,370	696.0	0.1 J	0.3 J	19.4 J	2,640 J	1.2 J	23 U	2300 UJ	46 U	78.2	61.8
41	RBS02SS150-224	06/10/03	0.5-1	FD	110 UJ	19,400	45 U	5.2 J	293.0	2.2 U	2.2 U	1,800 J	53.8	11.7 J	46.6	43,700	37.3	2,470	702.0	0.1 J	22 U	19.4 J	3,040 J	22 U	22 U	2200 UJ	45 U	77.1	54.8
41	RBS02SS41-223	06/10/03	0.5-1	NS1	110 UJ	20,100	43 U	7.3 J	305.0	2.2 U	2.2 U	1,890 J	57.3	12.4 J	49.5	48,200	41.6	2,500	772.0	0.1 J	0.5 J	20.5 J	3,130 J	22 U	22 U	2200 UJ	43 U	80.9	58.5
56	RBS02SS56-228	06/10/03	0.5-1	NS	110 UJ	20,100	45 U	4.4 J	421.0	2.3 U	2.3 U	1,760 J	57.0	13.5 J	48.6	46,900	31.0	2,520	812.0	0.1 J	23 U	20.6 J	2,990 J	1.7 J	23 U	2300 UJ	45 U	83.3	52.1
58	RBS02SS58-229	06/10/03	0.5-1	NS	110 UJ	10,200	43 U	2.2 J	271.0	2.1 U	2.1 U	765.0 J	27.7	6.2 J	29.1	24,900	16.4	1,320	366.0	0.21 U	21 U	10.2 J	1,670 J	1.1 J	21 U	2100 UJ	43 U	40.1	24.9
65	RBS02SS65-220	06/10/03	0.5-1	NS	120 UJ	21,000	46 U	6.0 J	252.0	2.3 U	2.3 U	2,000 J	57.2	12.2 J	50.4	46,000	62.4	2,640	724.0	0.1 J	0.4 J	20.9 J	3,340 J	1.1 J	23 U	2300 UJ	46 U	82.5	59.7
75	RBS02SS75-225	06/10/03	0.5-1	NS	110 UJ	19,300	43 U	5.3 J	414.0	2.2 U	2.2 U	1,810 J	52.6	12.3 J	45.3	45,100	39.1	2,320	774.0	0.1 J	22 U	19.2 J	2,890 J	22 U	22 U	2200 UJ	43 U	76.4	50.4
88	RBS02SS88-230	06/10/03	0.5-1	NS	110 UJ	16,200	44 U	3.8 J	330.0	2.2 U	2.2 U	1,590 J	45.5	11.2 J	42.7	39,100	44.6	2,090	700.0	0.1 J	22 U	17.0 J	2,340 J	0.9 J	22 U	2200 UJ	44 U	69.7	53.0

CH - chert

SS - soil sample

NS - Normal sample

NS1 - normal sample where a field duplicate was also collected

FD - field duplicate

J - estimated value

U - non detect at the practical quantitation limit

Table 3: Summary of Results
Malta Drive and O'Shaughnessy Blvd Site - RBS03 Data Summary

Analytical Method:					6010/7471A																								
Cell Location	Sample Location	Sample Date	Sample Depth	Sample Type	Sulfide (Acid Soluble)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
Malta Drive and O'Shaughnessy Blvd Site - Rock Sample Results																													
88	RBS03BA088-311	05/19/03	0-0.2	NS	100 UJ	21,800	10 U	19.9	407.0 J	0.5 UJ	0.5 U	965.0	47.3 J	31.7 J	159.0	78,700 J	24.0	1,950	7,000 J	0.2 J	5 U	65.5 J	853.0 J	1.9 J	1.2 J	5000 U	10 UJ	332.0	36.0 J
109	RBS03BA109-304	05/19/03	0-0.2	NS	100 UJ	19,400	10 U	1.3 J	628.0 J	0.5 UJ	0.5 U	1,160	36.3 J	45.2 J	119.0	63,400 J	9.3	3,540	7,400 J	0.1 J	5 U	65.0 J	619.0 J	3.8 J	1.2 J	5000 U	10 UJ	254.0	147.0 J
113	RBS03BA113-305	05/19/03	0-0.2	NS	100 UJ	32,500	10 U	10 U	705.0 J	0.5 UJ	0.5 U	1,400	38.1 J	74.4 J	157.0	86,300 J	11.7	8,060	8,110 J	0.1 J	5 U	103.0 J	763.0 J	3.5 J	1.6 J	5000 U	10 UJ	339.0	169.0 J
114	RBS03BA114-306	05/19/03	0-0.2	NS	100 UJ	35,600	10 U	10 U	747.0 J	0.5 UJ	0.5 U	2,040	37.0 J	60.9 J	174.0	103,000 J	18.2	11,900	9,010 J	0.0 J	5 U	103.0 J	647.0 J	5 UJ	1.1 J	10000 U	10 UJ	356.0	166.0 J
119	RBS03BA119-309	05/19/03	0-0.2	NS1	100 UJ	21,500	10 U	7.2 J	565.0 J	0.5 UJ	0.5 U	1,380	69.6 J	35.1 J	173.0	84,900 J	13.8	3,290	4,650 J	0.2	5 U	59.3 J	917.0 J	5 UJ	0.7 J	5000 U	10 UJ	270.0	130.0 J
119	RBS03BA119-310	05/19/03	0-0.2	FD	100 UJ	20,200	10 U	6.8 J	543.0 J	0.5 UJ	0.5 U	1,170	77.1 J	37.0 J	169.0	70,600 J	12.9	3,030	4,860 J	0.2 J	5 U	59.4 J	756.0 J	2.0 J	0.8 J	5000 U	10 UJ	225.0	76.7 J
136	RBS03BA136-313	05/19/03	0-0.2	NS	100 UJ	16,900	10 U	4.1 J	296.0 J	0.5 UJ	0.5 U	1,120	30.8 J	44.5 J	257.0	87,200 J	24.1	3,380	5,320 J	0.2	5 U	53.0 J	902.0 J	5 UJ	0.6 J	5000 U	10 UJ	133.0	48.6 J
143	RBS03BA143-316	05/19/03	0-0.2	NS	100 UJ	28,600	10 U	20.0	396.0 J	0.5 UJ	0.5 U	1,250	65.1 J	53.4 J	173.0	86,900 J	23.9	2,970	6,220 J	0.2 J	5 U	65.2 J	1,200 J	5 UJ	0.6 J	5000 U	10 UJ	156.0	68.0 J
2	RBS03CH002-300	05/19/03	0-0.2	NS1	100 UJ	4,850	10 U	7.8 J	238.0 J	0.5 UJ	0.5 U	221.0	10.9 J	9.3 J	61.8	19,100 J	10.9	388.0	4,120 J	0.0 J	5 U	23.2 J	156.0 J	2.6 J	0.6 J	5000 U	10 UJ	36.3	9.0 J
2	RBS03CH002-301	05/19/03	0-0.2	FD	100 UJ	5,140	10 U	16.8	563.0 J	0.5 UJ	0.5 U	391.0	11.6 J	12.6 J	119.0	41,300 J	35.8	679.0	9,620 J	0.1 J	5 U	42.8 J	181.0 J	5.3 J	1.3 J	5000 U	10 UJ	70.2	18.9 J
39	RBS03CH039-302	05/19/03	0-0.2	NS	100 UJ	24,600	10 U	31.4	487.0 J	0.5 UJ	0.5 U	964.0	56.0 J	35.7 J	158.0	81,400 J	33.0	1,760	9,020 J	0.4	5 U	70.1 J	781.0 J	2.7 J	1.2 J	5000 U	10 UJ	158.0	34.8 J
42	RBS03CH042-307	05/19/03	0-0.2	NS	100 UJ	32,600	10 U	34.2	446.0 J	0.5 UJ	0.5 U	1,060	64.4 J	27.4 J	139.0	73,300 J	28.2	2,200	6,970 J	0.3	5 U	75.0 J	1,120 J	1.8 J	0.8 J	5000 U	10 UJ	152.0	38.7 J
44	RBS03CH044-308	05/19/03	0-0.2	NS	100 UJ	22,000	10 U	29.1	633.0 J	0.5 UJ	0.5 U	973.0	38.1 J	19.7 J	178.0	77,600 J	35.1	1,820	10,300 J	0.3	5 U	82.7 J	868.0 J	4.8 J	1.2 J	5000 U	10 UJ	141.0	41.8 J
67	RBS03CH067-314	05/19/03	0-0.2	NS	100 UJ	9,190	10 U	4.8 J	139.0 J	0.5 UJ	0.5 U	837.0	24.7 J	17.7 J	188.0	92,500 J	24.7	2,680	4,450 J	0.0 J	5 U	49.3 J	575.0 J	5 UJ	5 UJ	5000 U	10 UJ	90.6	42.4 J
71	RBS03CH071-315	05/19/03	0-0.2	NS	100 UJ	25,800	10 U	27.2	570.0 J	0.5 UJ	0.5 U	1,100	53.4 J	39.4 J	198.0	86,400 J	28.1	2,650	7,730 J	0.2 J	5 U	69.9 J	1,110 J	2.1 J	0.6 J	5000 U	10 UJ	141.0	47.3 J
74	RBS03CH074-303	05/19/03	0-0.2	NS	100 UJ	22,700	10 U	9.7 J	409.0 J	0.5 UJ	0.5 U	1,130	43.5 J	50.3 J	147.0	110,000 J	21.6	2,360	8,710 J	0.1 J	5 U	62.5 J	1,060 J	5 UJ	1.2 J	10000 U	10 UJ	241.0	53.3 J
90	RBS03CH090-312	05/19/03	0-0.2	NS	100 UJ	18,500	10 U	7.8 J	663.0 J	0.5 UJ	0.5 U	1,240	47.3 J	31.3 J	174.0	127,000 J	32.8	2,170	7,710 J	0.1 J	5 U	60.8 J	1,370 J	5 UJ	0.9 J	10000 U	10 UJ	178.0	40.7 J
96 & 132 ¹	RBS03DS001-317	05/19/03	0-0.2	NS	100 UJ	14,400	10 U	5.6 J	239.0 J	0.5 UJ	0.5 U	1,550	40.0 J	28.1 J	119.0	203,000 J	49.1	1,630	4,330 J	0.2 J	5 U	45.6 J	1,890 J	5 UJ	5 UJ	5000 U	10 UJ	122.0	38.0 J
Malta Drive and O'Shaughnessy Blvd Site - Soil Sample Results																													
2	RBS03SS002-318	05/19/03	0-0.2	NS	100 UJ	10,700 J	10 U	19.7 J	1,160	0.51 U	0.3 J	1,260 J	19.1	30.3	269.0	85,100 J	52.0 J	2,560	22,100 J	0.3	5.1 U	101.0	1,200 J	9.2 J	2.6 J	5100 U	10 U	96.4 J	146.0
10	RBS03SS010-324	05/19/03	0-0.2	NS	110 UJ	15,300 J	11 U	9.2 J	692.0	0.53 U	0.53 U	3,580 J	34.3	30.0	153.0	76,400 J	71.3 J	6,310	9,040 J	0.1 J	5.3 U	62.3	1,710 J	3.2 J	1.2 J	5300 U	11 U	156.0 J	140.0
22	RBS03SS022-329	05/19/03	0-0.2	NS	110 UJ	7,780 J	11 U	10.4 J	638.0	0.53 U	0.53 U	1,000	21.6	12.8	97.5	59,600 J	47.6	1,360	5,990 J	0.21 U	5.3 U	29.4	1,470 J	3.3 J	0.7 J	5300 U	11 U	69.2 J	56.8
38	RBS03SS038-322	05/19/03	0-0.2	NS	100 UJ	1,740 J	10 U	3.2 J	173.0	0.51 U	0.51 U	766.0 J	2.7 J	1.9 J	32.2	4,340 J	3.3 J	385.0	2,010 J	0.2 U	5.1 U	14.6	119.0 J	1.4 J	5.1 UJ	5100 U	10 U	9.0 J	12.5
39	RBS03SS039-323	05/19/03	0-0.2	NS	110 UJ	14,200 J	11 U	6.2 J	507.0	0.55 U	0.55 U	3,130 J	34.7	23.9	106.0	64,600 J	71.0 J	5,080	5,410 J	0.1 J	5.5 U	50.4	1,310 J	3.5 J	0.6 J	5500 U	11 U	112.0 J	104.0
43	RBS03SS043-326	05/19/03	0-0.2	NS	110 UJ	15,700 J	11 U	9.1 J	970.0	0.54 U	0.3 J	2,390 J	34.2	26.6	170.0	77,100 J	66.2 J	4,760	10,100 J	0.1 J	5.4 U	63.9	1,810 J	2.7 J	1.0 J	5400 U	11 U	125.0 J	117.0
52	RBS03SS052-330	05/19/03	0-0.2	NS	100 UJ	5,260 J	10 U	5.6 J	539.0	0.51 U	0.51 U	804.0 J	12.8	9.8	87.4	35,700 J	29.1 J	927.0	5,530 J	0.2 U	5.1 U	23.7	944.0 J	2.6 J	0.7 J	5100 U	10 U	40.0 J	42.3
60	RBS03SS060-332	05/19/03	0-0.2	NS	100 UJ	8,880 J	10 U	9.2 J	1,010	0.52 U	0.4 J	1,550 J	20.4	19.6	158.0	61,800 J	50.4 J	2,170	11,300 J	0.3	5.2 U	68.2	1,060 J	6.4 J	1.4 J	5200 U	10 U	86.7 J	113.0
62	RBS03SS062-319	05/19/03	0-0.2	NS	110 UJ	16,800 J	11 U	8.0 J	495.0	0.53 U	0.53 U	3,190 J	37.4	26.7	111.0	63,000 J	93.7 J	5,090	8,070 J	0.2 J	5.3 U	69.6	1,250 J	3.8 J	0.9 J	5300 U	11 U	128.0 J	135.0
63	RBS03SS063-320	05/19/03	0-0.2	NS	110 UJ	14,500 J	11 U	7.7 J	430.0	0.54 U	0.54 U	3,610 J	38.2	21.6	93.6	71,300 J	77.6 J	5,090	8,490 J	0.1 J	5.4 U	56.3	1,110 J	2.6 J	0.8 J	5400 U	11 U	123.0 J	112.0
72	RBS03SS072-325	05/19/03	0-0.2	NS	100 UJ	16,300 J	10 U	10.7 J	1,320	0.52 U	0.5 J	2,690 J	34.4	27.8	162.0	88,500 J	71.6 J	5,560	11,100 J	0.1 J	5.2 U	61.8	2,020 J	3.6 J	1.5 J	5200 U	10 U	148.0 J	126.0
74	RBS03SS074-327	05/19/03	0-0.2	NS	110 UJ	13,300 J	11 U	7.3 J	480.0	0.56 U	0.56 U	2,340 J	28.8	24.1	107.0	61,100 J	50.2 J	5,150	5,570 J	0.23 U	5.6 U	45.4	1,280 J	1.8 J	5.6 UJ	5600 U	11 U	134.0 J	106.0
94	RBS03SS094-321	05/19/03	0-0.2	NS	110 UJ	16,000 J	11 U	7.5 J	552.0	0.53 U	0.53 U	3,790 J	38.3	24.2	114.0	58,500 J	71.9 J	6,300	8,350 J	0.1 J	5.3 U	71.7	1,280 J	2.7 J	1.1 J	5300 U	11 U	137.0 J	139.0
134	RBS03SS134-328	05/19/03	0-0.2	NS	100 UJ	4,200 J	10 U	5.0 J	341.0	0.52 U	0.52 U	1,240 J	16.1	11.4	77.2	29,500 J	26.2 J	1,550	6,470 J	0.21 U	5.2 U	34.9	615.0 J	2.7 J	0.7 J	5200 U	10 U	45.6 J	55.5
148	RBS03SS148-331	05/19/03	0-0.2	NS	100 UJ	3,780 J	10 U	3.2 J	381.0	0.52 U	0.52 U	1,560 J	9.0	5.5	38.6	20,100 J	30.8 J	1,000	2,000 J	0.2 J	5.2 U	13.6	800.0 J	5.2 UJ	5.2 UJ	5200 U	10 U	20.1 J	62.3

1. The discreet sample RBS03DS001-317 was collected between grids 96 and 132.

BA - basalt

CH - Chert

SS - soil sample

NS - Normal sample

NS1 - normal sample where a field duplicate was also collected

FD - field duplicate

J - estimated value

U - non detect at the practical quantitation limit

FIGURES





Twin Peaks Boulevard



Malta and O'Shaughnessy Streets



Tetra Tech EM Inc.

Hunters Point Shipyard
U.S. Navy Southwest Division NAVFAC, San Diego

**FIGURE 2
LOCATIONS OF REGIONAL
BEDROCK SITES**

Regional Bedrock Sites Metal Evaluation SAP

Figure 3
Soil and Rock Grids using Random Number Generation for Sample Collection,
RBS01 - Innes Avenue Site
San Francisco, California

Grid 1 - Rock Grid

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150

Grid 2 - Soil Grid

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150

Figure 4
Soil and Rock Grids using Random Number Generation for Sample Collection
RBS02 - Twin Peaks
San Francisco, California
Grid 1 - Rock Grid

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150

Grid 2 Soil Grid

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150

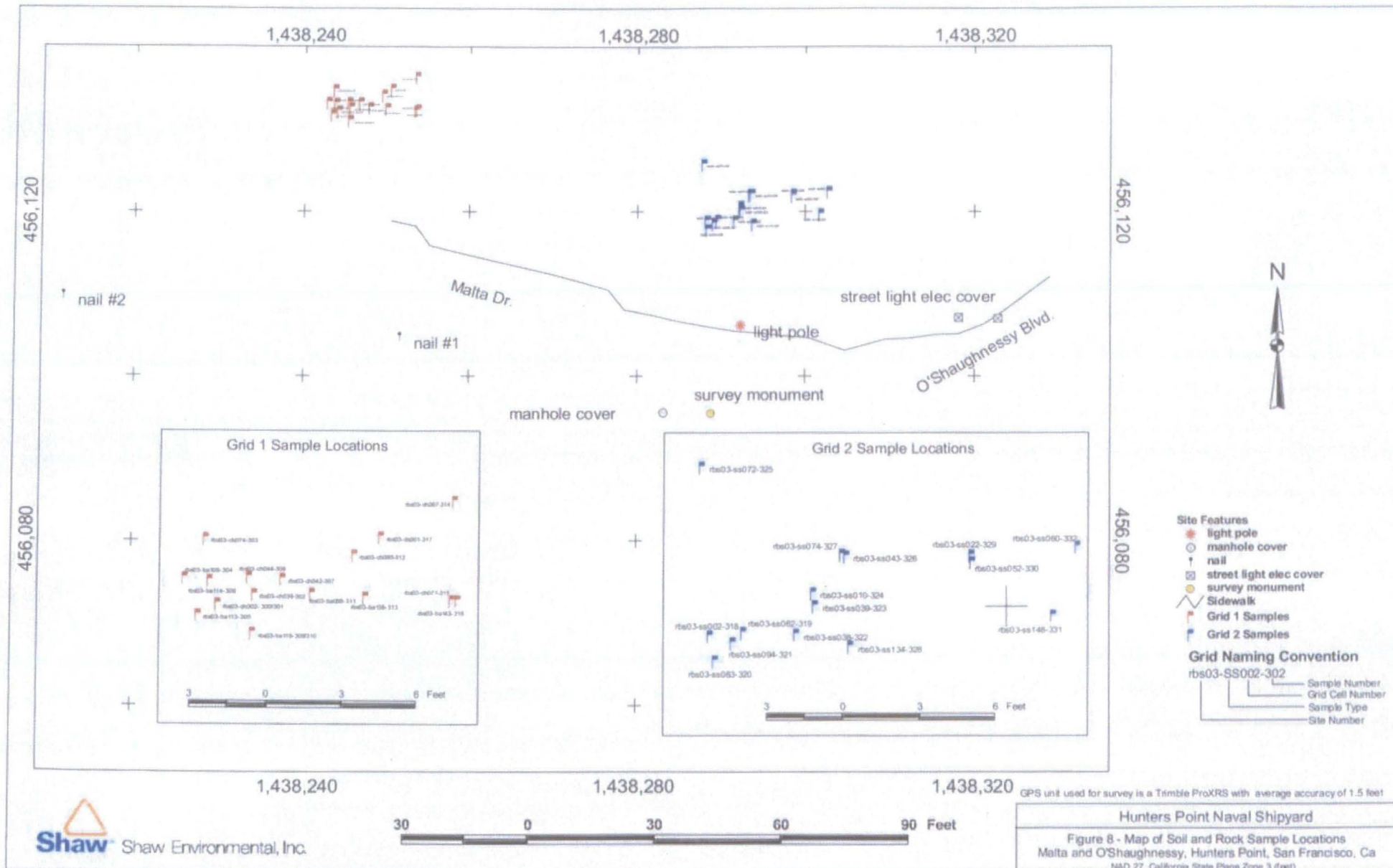
Figure 5
Soil and Rock Grids using Random Number Generation for Sample Collection
RBS03 - Malta and O'Shaughnessy
San Francisco, California
Grid 1 - Rock Grid (Revised in the field)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	
74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	
109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144
145	146	147	148	149	150																														

- Note:
1. Due to the lack of samples within the last row, it was not layed out in the grid presented in the field nor on the sample collection forms.
 2. The discrete sample, RBS03DS001-317 was collected in an area between cell 96 cell 132, and is not shown because it was not a random sample.

Grid 2 - Soil Grid

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150



ATTACHMENT 1

**ENCROACHMENT PERMIT AND
ENCROACHMENT PERMIT - ADDENDUM**

TEMPORARY MINOR ENCROACHMENT PERMIT

May 12, 2003

Keith Forman, BRAC Environmental Coordinator
Beth Flanagan (619) 532-0788
Department of the Navy, Southwest Division
1220 Pacific Highway
San Diego, CA 92132
(619) 532-0913 Phone (619) 532-0995 Fax

Shaw Environmental & Infrastructure
4005 Port Chicago Hwy
Concord, CA 94520
(925) 288-2305

Dear Mr. Keith Forman:

This is in reference to the request for encroachment on hill side of Glen Canyon property located at Malta Drive and O'Shaughnessy Boulevard to collect samples from bedrock outcrops and bedrock-derived soil using hand tools. Sample locations for the type of bedrock outcrops required for this study will be based on the professional judgment of the field team. Wash water used to clean the sampling equipment will be removed from the site on a daily basis. Holes or depressions made while sampling will be filled and smoothed to match the existing surface. No heavy machinery of any kind will be present at the site.

The work is scheduled to begin May 12 and will be completed by May 23, 2003. The duration of encroachment will be for one (1) day only.

Please see attachment of site vicinity map, location of regional bedrock sites, and the City and County of San Francisco Map of Malta Drive and O'Shaughnessy Boulevard intersection.


The Recreation and Park representative (Robert McDonald, Planning Unit Manager) may at any time, stop any portion of the work, if he deems that the work endangers existing trees/roots creates an unsafe condition to the public, or park property. Mr. Robert McDonald may be reach at (415) 831-2791.

Please provide appropriate signage and monitors to ensure the safety of the public.

This Temporary Minor Encroachment Permit will become valid upon receipt of a **ENCROACHMENT FEE OF \$500.00**, due no later than June 20, 2003.

The Department of The Navy is self insured.

Please take all necessary precaution to insure the safety of park users, disabled people and pedestrians during this project.

Sincerely yours 
Sandy Lee, Supervisor of Permits/Reservations

CC: D. McKenna, L. Ma, Shawna McGrew, M. Bertucelli, Angela Maestri, SFPD Ingelsind Stn. Park Patrol

Mailing Address:
Permits & Reservations
501 Stanyan Street
San Francisco, CA 94117-1898

Permits & Reservations: (415) 831-5500
Fax: (415) 831-5522
Location: John F. Kennedy & Stow Lake Drives, GGP

TEMPORARY MINOR ENCROACHMENT PERMIT

ADDENDUM

June 6, 2003

Keith Forman, BRAC Environmental Coordinator
Beth Flanagan (619) 532-0788
Department of the Navy, Southwest Division
1220 Pacific Highway
San Diego, CA 92132
(619) 532-0913 Phone (619) 532-0995 Fax

Shaw Environmental & Infrastructure
4005 Port Chicago Hwy
Concord, CA 94520
(925) 288-2305

Dear Mr. Keith Forman and Beth Flanagan:

This is in reference to the request for encroachment on the "open space" on Twin Peaks property located at Twin Peaks Boulevard and Christmas Tree Point Road to collect samples from bedrock outcrops and bedrock-derived soil using hand tools. Sample locations for the type of bedrock outcrops required for this study will be based on the professional judgment of the field team. Wash water used to clean the sampling equipment will be removed from the site on a daily basis. Holes or depressions made while sampling will be filled and smoothed to match the existing surface. No heavy machinery of any kind will be present at the site.

The work is scheduled to begin June 10, 2003 and will be completed by June 10, 2003. The duration of encroachment will be for one (1) day only.

Please see attachment of site vicinity map and location of bedrock site.

The Recreation and Park representative (Robert McDonald, Planning Unit Manager) may at any time, stop any portion of the work, if he deems that the work endangers existing trees/roots creates an unsafe condition to the public, or park property. Mr. Robert McDonald may be reach at (415) 831-2791.

Please provide appropriate signage and monitors to ensure the safety of the public.

The Department of The Navy is self insured.

Please take all necessary precaution to insure the safety of park users, disabled people and pedestrians during this project.

Sincerely yours

Sandy Lee, Supervisor of Permits/Reservations

CC: D. McKenna, L. Ma, Shawna McGrew, M. Bertucelli, Angela Maestri, SFPD Ingelsind Stn. Park Patrol

ATTACHMENT 2

ENVIRONMENTAL SAMPLE ANALYTICAL LABORATORY REPORTS WITH CHAIN OF CUSTODY RECORDS



A P C L

Applied Physics & Chemistry Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel. (909) 590-1828 Fax (909) 590-1498

June 18, 2003

Shaw E & I

Attention: Suman Sharma

4005 Port Chicago Highway

Concord CA 94520-1120

Dear Suman,

This package contains samples in our Service ID 03-3653 and your project EMAC-Hunters Point.
Enclosed please find:

- (1) Original Analytical Report.
- (2) Original Chain of Custody.
- (3) One Original and one compact disc of Level C Data Package Deliverable.
- (4) One diskette containing EDD deliverables.

If anything is missing or you have any questions, please feel free to contact me.

Respectfully submitted,

Regina Kirakozova

Associate QA/QC Director

Applied P & Ch Laboratory

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel: (909) 590-1828 Fax: (909) 590-1498

Submitted to:

Shaw E & I

Attention: Suman Sharma

4005 Port Chicago Highway

Concord CA 94520-1120

Tel: (925)288-9898 Fax: (925)827-5927

APCL Analytical Report

Service ID #: 801-033653

Collected by: JS/SS

Collected on: 06/10/03

Received: 06/11/03

Extracted: N/A

Tested: 06/11-14/03

Reported: 06/17/03

Sample Description: Soil and Water from Site 2

Project Description: 843812 EMAC-Hunters Point

Analysis of Water and Soil Samples

I . Analysis of Water Samples

Component Analyzed	Method	Unit	PQL	Analysis Result	
				RBS02EB1-240	03-03653-1
SULFIDE, ACID SOLUBLE	9030B	mg/L	10	<10	
METALS, TOTAL				1	
Dilution Factor				24.5J	
ALUMINUM	SW6010B	µg/L	200	3.2J	
ANTIMONY	SW6010B	µg/L	6	<50	
ARSENIC	SW6010B	µg/L	50	1.4J	
BARIUM	SW6010B	µg/L	100	0.10J	
BERYLLIUM	SW6010B	µg/L	4	<5	
CADMIUM	SW6010B	µg/L	5	158J	
CALCIUM	SW6010B	µg/L	500	2.6J	
CHROMIUM	SW6010B	µg/L	10	<10	
COBALT	SW6010B	µg/L	10	1.7J	
COPPER	SW6010B	µg/L	10	57.1J	
IRON	SW6010B	µg/L	100	<10	
LEAD	SW6010B	µg/L	10	39.0J	
MAGNESIUM	SW6010B	µg/L	500	1.3J	
MANGANESE	SW6010B	µg/L	10	0.083J	
MERCURY	SW7470A	µg/L	0.2	1.1J	
MOLYBDENUM	SW6010B	µg/L	50	0.80J	
NICKEL	SW6010B	µg/L	20	176J	
POTASSIUM	SW6010B	µg/L	500	3.3J	
SELENIUM	SW6010B	µg/L	20	<10	
SILVER	SW6010B	µg/L	10	238J	
SODIUM	SW6010B	µg/L	500	<10	
THALLIUM	SW6010B	µg/L	10	<50	
VANADIUM	SW6010B	µg/L	50	10.2J	
ZINC	SW6010B	µg/L	20		

II . Analysis of Soil Samples

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS02SS05-217 03-03653-2	RBS02SS10-222 03-03653-3	RBS02SS26-227 03-03653-4	RBS02SS35-219 03-03653-5
MOISTURE	ASTM-D2216	%Moisture	0.5	10.8	10.7	10	12.1
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	<110	<110	<110	<110

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS02SS05-217 03-03653-2	RBS02SS10-222 03-03653-3	RBS02SS26-227 03-03653-4	RBS02SS35-219 03-03653-5
METALS, TOTAL							
Dilution Factor				4	4	4	4
ALUMINUM	SW6010B	mg/kg	50	18,800	19,400	18,000	17,700
ANTIMONY	SW6010B	mg/kg	10	< 45	< 45	< 44	< 46
ARSENIC	SW6010B	mg/kg	10	5.7J	4.9J	5.1J	5.9J
BARIUM	SW6010B	mg/kg	10	233	293	385	234
BERYLLIUM	SW6010B	mg/kg	0.5	< 2.2	< 2.2	< 2.2	< 2.3
CADMIUM	SW6010B	mg/kg	0.5	0.11J	0.055J	< 2.2	0.12J
CALCIUM	SW6010B	mg/kg	100	1,710	1,820	1,430	1,870
CHROMIUM	SW6010B	mg/kg	5	51.5	56.5	47.5	52.9
COBALT	SW6010B	mg/kg	5	10.9J	11.7J	12.5J	11.9J
COPPER	SW6010B	mg/kg	5	46.1	48.8	47.6	48.0
Dilution Factor				4	10	4	4
IRON	SW6010B	mg/kg	10	40,900	46,200	43,500	42,100
Dilution Factor				4	4	4	4
LEAD	SW6010B	mg/kg	1	52.5	38.4	36.0	71.8
MAGNESIUM	SW6010B	mg/kg	50	2,360	2,460	2,130	2,370
MANGANESE	SW6010B	mg/kg	2	640	701	815	696
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.12J	0.079J	0.10J	0.15J
Dilution Factor				4	4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	0.50J	0.40J	< 22	0.34J
NICKEL	SW6010B	mg/kg	5	18.8J	21.2J	17.9J	19.4J
POTASSIUM	SW6010B	mg/kg	500	3,080	3,030	2,620	2,640
SELENIUM	SW6010B	mg/kg	5	1.8J	1.1J	0.70J	1.2J
SILVER	SW6010B	mg/kg	5	< 22	< 22	< 22	< 23
SODIUM	SW6010B	mg/kg	500	< 2200	< 2200	< 2200	< 2300
THALLIUM	SW6010B	mg/kg	10	< 45	< 45	< 44	< 46
VANADIUM	SW6010B	mg/kg	5	75.3	80.5	73.4	78.2
ZINC	SW6010B	mg/kg	2	54.3	57.5	48.1	61.8

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS02SS41-223 03-03653-6	RBS02SS56-228 03-03653-7	RBS02SS58-229 03-03653-8	RBS02SS65-220 03-03653-9
MOISTURE	ASTM-D2216	%Moisture	0.5	7.7	11.3	6.9	13.2
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 110	< 110	< 110	< 120

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS02SS41-223	RBS02SS56-228	RBS02SS58-229	RBS02SS65-220
				03-03653-6	03-03653-7	03-03653-8	03-03653-9
METALS, TOTAL							
Dilution Factor				4	4	4	4
ALUMINUM	SW6010B	mg/kg	50	20,100	20,100	10,200	21,000
ANTIMONY	SW6010B	mg/kg	10	< 43	< 45	< 43	< 46
ARSENIC	SW6010B	mg/kg	10	7.3J	4.4J	2.2J	6.0J
BARIUM	SW6010B	mg/kg	10	305	421	271	252
BERYLLIUM	SW6010B	mg/kg	0.5	< 2.2	< 2.3	< 2.1	< 2.3
CADMIUM	SW6010B	mg/kg	0.5	0.060J	< 2.3	< 2.1	0.082J
CALCIUM	SW6010B	mg/kg	100	1,890	1,760	765	2,000
CHROMIUM	SW6010B	mg/kg	5	57.3	57.0	27.7	57.2
COBALT	SW6010B	mg/kg	5	12.4J	13.5J	6.2J	12.2J
COPPER	SW6010B	mg/kg	5	49.5	48.6	29.1	50.4
Dilution Factor				10	10	4	10
IRON	SW6010B	mg/kg	10	48,200	46,900	24,900	46,000
Dilution Factor				4	4	4	4
LEAD	SW6010B	mg/kg	1	41.6	31.0	16.4	62.4
MAGNESIUM	SW6010B	mg/kg	50	2,500	2,520	1,320	2,640
MANGANESE	SW6010B	mg/kg	2	772	812	366	724
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.091J	0.083J	0.020J	0.12J
Dilution Factor				4	4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	0.54J	< 23	< 21	0.36J
NICKEL	SW6010B	mg/kg	5	20.5J	20.6J	10.2J	20.9J
POTASSIUM	SW6010B	mg/kg	500	3,130	2,990	1,670J	3,340
SELENIUM	SW6010B	mg/kg	5	0.55J	1.7J	1.1J	1.1J
SILVER	SW6010B	mg/kg	5	< 22	< 23	< 21	< 23
SODIUM	SW6010B	mg/kg	500	< 2200	< 2300	< 2100	< 2300
THALLIUM	SW6010B	mg/kg	10	< 43	< 45	< 43	< 46
VANADIUM	SW6010B	mg/kg	5	80.9	83.3	40.1	82.5
ZINC	SW6010B	mg/kg	2	58.5	52.1	24.9	59.7

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02SS75-225	RBS02SS88-230	RBS02SS100-218
				03-03653-10	03-03653-11	03-03653-12
MOISTURE	ASTM-D2216	%Moisture	0.5	7.9	9.9	10.5
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 110	< 110	< 110

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02SS75-225 03-03653-10	RBS02SS88-230 03-03653-11	RBS02SS100-218 03-03653-12
METALS, TOTAL						
Dilution Factor				4	4	4
ALUMINUM	SW6010B	mg/kg	50	19,300	16,200	16,300
ANTIMONY	SW6010B	mg/kg	10	< 43	< 44	< 45
ARSENIC	SW6010B	mg/kg	10	5.3J	3.8J	4.0J
BARIUM	SW6010B	mg/kg	10	414	330	205
BERYLLIUM	SW6010B	mg/kg	0.5	< 2.2	< 2.2	< 2.2
CADMIUM	SW6010B	mg/kg	0.5	0.039J	0.060J	< 2.2
CALCIUM	SW6010B	mg/kg	100	1,810	1,590	1,500
CHROMIUM	SW6010B	mg/kg	5	52.6	45.5	47.1
COBALT	SW6010B	mg/kg	5	12.3J	11.2J	9.5J
COPPER	SW6010B	mg/kg	5	45.3	42.7	40.8
Dilution Factor				10	4	4
IRON	SW6010B	mg/kg	10	45,100	39,100	37,000
Dilution Factor				4	4	4
LEAD	SW6010B	mg/kg	1	39.1	44.6	43.0
MAGNESIUM	SW6010B	mg/kg	50	2,320	2,090	2,080
MANGANESE	SW6010B	mg/kg	2	774	700	531
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.088J	0.11J	0.11J
Dilution Factor				4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	0.28J	< 22	0.21J
NICKEL	SW6010B	mg/kg	5	19.2J	17.0J	16.0J
POTASSIUM	SW6010B	mg/kg	500	2,890	2,340	2,530
SELENIUM	SW6010B	mg/kg	5	0.61J	0.90J	1.4J
SILVER	SW6010B	mg/kg	5	< 22	< 22	< 22
SODIUM	SW6010B	mg/kg	500	< 2200	< 2200	< 2200
THALLIUM	SW6010B	mg/kg	10	< 43	< 44	< 45
VANADIUM	SW6010B	mg/kg	5	76.4	69.7	65.7
ZINC	SW6010B	mg/kg	2	50.4	53.0	47.9

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02SS118-231 03-03653-13	RBS02SS120-232 03-03653-14	RBS02SS129-221 03-03653-15
MOISTURE	ASTM-D2216	%Moisture	0.5	11.3	10.8	10.2
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 110	< 110	< 110

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel: (909) 590-1828 Fax: (909) 590-1498

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02SS118-231 03-03653-13	RBS02SS120-232 03-03653-14	RBS02SS129-221 03-03653-15
METALS, TOTAL						
Dilution Factor				4	4	4
ALUMINUM	SW6010B	mg/kg	50	18,800	17,400	18,600
ANTIMONY	SW6010B	mg/kg	10	< 45	< 45	< 45
ARSENIC	SW6010B	mg/kg	10	4.8J	4.6J	5.5J
BARIUM	SW6010B	mg/kg	10	428	394	380
BERYLLIUM	SW6010B	mg/kg	0.5	< 2.3	< 2.2	< 2.2
CADMIUM	SW6010B	mg/kg	0.5	< 2.3	0.072J	0.065J
CALCIUM	SW6010B	mg/kg	100	1,670	1,610	1,730
CHROMIUM	SW6010B	mg/kg	5	51.4	49.9	53.0
COBALT	SW6010B	mg/kg	5	12.0J	11.6J	11.2J
COPPER	SW6010B	mg/kg	5	44.4	46.0	47.3
IRON	SW6010B	mg/kg	10	43,900	40,400	42,800
LEAD	SW6010B	mg/kg	1	25.8	50.6	45.8
MAGNESIUM	SW6010B	mg/kg	50	2,360	2,320	2,360
MANGANESE	SW6010B	mg/kg	2	703	757	649
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.074J	0.13J	0.11J
Dilution Factor				4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	< 23	< 22	0.50J
NICKEL	SW6010B	mg/kg	5	19.2J	18.1J	18.2J
POTASSIUM	SW6010B	mg/kg	500	2,790	2,760	2,880
SELENIUM	SW6010B	mg/kg	5	0.51J	1.4J	1.0J
SILVER	SW6010B	mg/kg	5	< 23	< 22	< 22
SODIUM	SW6010B	mg/kg	500	< 2300	< 2200	< 2200
THALLIUM	SW6010B	mg/kg	10	< 45	< 45	< 45
VANADIUM	SW6010B	mg/kg	5	77.4	73.3	75.9
ZINC	SW6010B	mg/kg	2	49.8	52.5	54.1

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02SS143-226 03-03653-16	RBS02SS150-224 03-03653-17	RBS02SS150-233 03-03653-18
MOISTURE	ASTM-D2216	%Moisture	0.5	8.7	11.0	9.6
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 110	< 110	< 110

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02SS143-226 03-03653-16	RBS02SS150-224 03-03653-17	RBS02SS150-233 03-03653-18
METALS, TOTAL						
Dilution Factor				4	4	4
ALUMINUM	SW6010B	mg/kg	50	19,800	19,400	21,400
ANTIMONY	SW6010B	mg/kg	10	< 44	< 45	< 44
ARSENIC	SW6010B	mg/kg	10	4.9J	5.2J	4.4J
BARIUM	SW6010B	mg/kg	10	363	293	535
BERYLLIUM	SW6010B	mg/kg	0.5	< 2.2	< 2.2	< 2.2
CADMIUM	SW6010B	mg/kg	0.5	< 2.2	0.049J	< 2.2
CALCIUM	SW6010B	mg/kg	100	1,820	1,800	1,480
CHROMIUM	SW6010B	mg/kg	5	56.3	53.8	54.6
COBALT	SW6010B	mg/kg	5	12.9J	11.7J	12.5J
COPPER	SW6010B	mg/kg	5	49.5	46.6	51.7
Dilution Factor				10	4	10
IRON	SW6010B	mg/kg	10	47,000	43,700	49,500
Dilution Factor				4	4	4
LEAD	SW6010B	mg/kg	1	38.0	37.3	28.4
MAGNESIUM	SW6010B	mg/kg	50	2,570	2,470	2,530
MANGANESE	SW6010B	mg/kg	2	835	702	642
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.10J	0.10J	0.076J
Dilution Factor				4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	< 22	0.16J	< 22
NICKEL	SW6010B	mg/kg	5	20.2J	19.4J	20.1J
POTASSIUM	SW6010B	mg/kg	500	3,090	3,040	3,060
SELENIUM	SW6010B	mg/kg	5	1.1J	0.79J	0.98J
SILVER	SW6010B	mg/kg	5	< 22	< 22	< 22
SODIUM	SW6010B	mg/kg	500	< 2200	< 2200	< 2200
THALLIUM	SW6010B	mg/kg	10	< 44	< 45	< 44
VANADIUM	SW6010B	mg/kg	5	83.8	77.1	84.8
ZINC	SW6010B	mg/kg	2	57.6	54.8	46.4

PQL: Practical Quantitation Limit. MDL: Method Detection Limit. CRDL: Contract Required Detection Limit

N.D.: Not Detected or less than the practical quantitation limit.

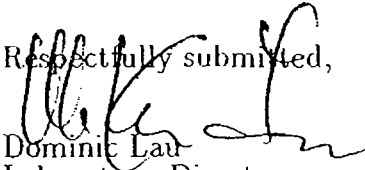
"-": Analysis is not required.

J: Reported between PQL and MDL.

† All results are reported on dry basis for soil samples.

Listed Dilution Factors (DF) are relative to the method default DF. All unlisted DFs are 1.0

Respectfully submitted,



Dominic Lau
Laboratory Director
Applied P & Ch Laboratory

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1 <u>2</u> & 3 Source 1
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SHAW Contact (Name and Phone Number)	Suman Sharma (925) 288-2332
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Name of Sampler:	JS/SS
------------------	--------------

COOLER
TEMPERATURE:

3.4°C

COC #: 1031

Lab: APCL

Purchase Order No: _____

Courier Company: _____

Courier No: **UPS**

Cooler: **1** of **1**

Ship Date: **6/10/03**

Aqueous Preservative			ice, HNO3	ice, NaOH/Zn Acetate	Check if MS/MSD (requires double volume)	COMMENTS
Aqueous Container			1x0.5L PE	1x0.5L PE		
Solid Preservative			ice	ice		
Solid Container			8 oz jar	8 oz jar		
Sample ID	Sample Date mm/dd/yy	Sample Time	Metals-Total ICP (EPA 6010B/7471A/7470A, SW-846)	Acid Soluble Sulfide (SW9030B, SW-846)	MATRIX	
Temperature Blank					A	One 40 mL in each cooler
RB S02 CH 150-211	6/10/03	0930	✓	✓	S/Rock	Rock Pulverization
RB S02 CH 53-212		0927	↓	↓	↓	↓
RB S02 CH 112-213		0932	↓	↓	↓	↓
RB S02 CH 145-214		0940	↓	↓	↓	↓
RB S02 CH 118-215		0942	↓	↓	↓	↓
RB S02 CH 60-216		0945	↓	↓	↓	↓
RB S02 SS 05-217		0950	↓	↓	S	
RB S02 SS 100-218		1000	↓	↓	↓	
RB S02 SS 35-219		1005	↓	↓	↓	
RB S02 SS 65-220		1008	↓	↓	↓	
RB S02 SS 129-221	✓	1015	↓	↓	↓	

TAT → 48 hours rush on metals, 5-day rush on acid sulfides

Relinquished by: (Signature) Suman Sharma	Date / Time 6/10/03 1400	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time 6/11/03 1000	Received by: (Signature) 	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1 <u>2</u> & 3 Source 1	COOLER TEMPERATURE: <div style="border: 1px solid black; padding: 5px; display: inline-block;">5.1°C</div>	COC #: 1032 Lab: APCL Cooler: 1 of 1 Ship Date: 6/10/03
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332		Purchase Order No: _____ Courier Company: _____ Courier No: UPS	
Name of Sampler: JS/SS			

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
Temperature Blank				Metals-Total ICP (EPA 6010B/7471A/7470A, SW-846)	Acid Soluble Sulfide (SW9030B, SW-846)	A		One 40 mL in each cooler
RB S02SS10-222	6/10/03	1020		✓	✓	S		
RB S02SS41-223		1025						
RB S02SS150-224		1030						
RB S02SS75-225		1035						
RB S02SS143-226		1040						
RB S02SS26-227		1045						
RB S02SS56-228		1050						
RB S02SS58-229		1055						
RB S02SS88-230		1100						
RB S02SS118-231		1105						
RB S02SS120-232		1110		✓	✓	✓		

RAT → 48 hours Rush on metals, 5-day rush on Acid Sulfides

Relinquished by: (Signature) Suman Sharma	Date / Time 6/10/03 1400	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time 6/10/03 1000	Received by: (Signature) 	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)



Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1 2 & 3 <div style="text-align: right;">Source 1</div>
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler: JS / SS	

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> COOLER TEMPERATURE: </div> <div style="border: 2px solid black; padding: 10px; display: inline-block; margin-bottom: 10px;"> 5.1°C </div> <div> Purchase Order No: _____ Courier Company: _____ Courier No: UPS </div>	<div> COC #: 1033 Lab: APCL Cooler: 1 of 7 Ship Date: 8/10/03 </div>
---	--

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO ₃	ice, NaOH/Zn Acetate	Check if MS/MSD (requires double volume)	COMMENTS	
			Aqueous Container	1x0.5L PE	1x0.5L PE			Aqueous (A)
			Solid Preservative	ice	ice			Solid (S)
			Solid Container	8 oz jar	8 oz jar			
			Metals-Total ICP (EPA 6010B/7471A/7470A, SW-846)	Acid Soluble Sulfide (SW9030B, SW-846)	MATRIX			
Temperature Blank					A		One 40 mL in each cooler	
RBS02 SS150-233	6/10/03	1115	✓	✓	S	✓		
RBS02 EB1-240	6/10/03	1230	✓	✓	SDA			
<div style="text-align: center;"> <p>See Sh</p> <p>6/10/03.</p> </div>								

TAT - 48 hours rush on metals, 5-day rush on Acid Sulphides.

Relinquished by: (Signature) 	Date / Time 6/10/03 1400	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time 6/11/03 1000	Received by: (Signature) 	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)



A P C L

Applied Physics & Chemistry Laboratory

13780 Magnolia Ave. Chino CA 91710

Tel. (909) 590-1828 Fax (909) 590-1498

June 19, 2003

Shaw E & I

Attention: Suman Sharma
4005 Port Chicago Highway
Concord CA 94520-1120

Dear Suman,

This package contains samples in our Service ID 03-3651 and your project EMAC-Hunters Point.
Enclosed please find:

- (1) Original Analytical Report.
- (2) Original Chain of Custody.
- (3) One Original and one compact disc of Level C Data Package Deliverable.
- (4) One diskette containing EDD deliverables.

If anything is missing or you have any questions, please feel free to contact me.

Respectfully submitted,

Regina Kirakozova

Associate QA/QC Director
Applied P & Ch Laboratory

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel: (909) 590-1828 Fax: (909) 590-1498

Submitted to:

Shaw E & I

Attention: Suman Sharma

4005 Port Chicago Highway

Concord CA 94520-1120

Tel: (925) 288-9898 Fax: (925) 827-5927

APCL Analytical Report

Service ID #: 801-033651

Collected by: JS/SS

Collected on: 06/10/03

Received: 06/11/03

Extracted: N/A

Tested: 06/12-18/03

Reported: 06/18/03

Sample Description: Rock from Site 2

Project Description: 843812 EMAC-Hunters Point

Analysis of Rock Samples

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS02CH12-205 03-03651-1	RBS02CH16-207 03-03651-2	RBS02CH22-210 03-03651-3	RBS02CH42-206 03-03651-4
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100
METALS, TOTAL							
Dilution Factor				4	4	4	4
ALUMINUM	SW6010B	mg/kg	50	8,740	3,210	7,210	15,000
ANTIMONY	SW6010B	mg/kg	10	< 40	< 40	< 40	< 40
ARSENIC	SW6010B	mg/kg	10	33.8J	10.8J	16.7J	37.9J
BARIUM	SW6010B	mg/kg	10	1,610	1,540	943	4,390
BERYLLIUM	SW6010B	mg/kg	0.5	< 2	0.38J	< 2	< 2
CADMIUM	SW6010B	mg/kg	0.5	0.74J	0.18J	0.12J	0.55J
CALCIUM	SW6010B	mg/kg	100	585	297J	531	889
CHROMIUM	SW6010B	mg/kg	5	14.8J	12.9J	7.8J	16.8J
COBALT	SW6010B	mg/kg	5	20.7	11.7J	31.0	34.8
COPPER	SW6010B	mg/kg	5	194	137	180	336
Dilution Factor				20	4	20	20
IRON	SW6010B	mg/kg	10	66,300	15,100	60,700	107,000
Dilution Factor				4	4	4	4
LEAD	SW6010B	mg/kg	1	43.1	12.8	51.8	77.3
MAGNESIUM	SW6010B	mg/kg	50	1,210	527	1,150	2,390
Dilution Factor				20	20	20	20
MANGANESE	SW6010B	mg/kg	2	14,500	14,300	15,800	10,500
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.075J	0.025J	0.050J	0.085J
Dilution Factor				4	4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	0.19J	0.77J	< 20	< 20
NICKEL	SW6010B	mg/kg	5	63.4	81.5	99.3	143
POTASSIUM	SW6010B	mg/kg	500	1,130J	179J	590J	2,290
SELENIUM	SW6010B	mg/kg	5	10.7J	9.4J	10.3J	23.3
SILVER	SW6010B	mg/kg	5	0.13J	0.71J	0.44J	1.6J
SODIUM	SW6010B	mg/kg	500	< 2000	64.4J	< 2000	< 2000
THALLIUM	SW6010B	mg/kg	10	< 40	2.3J	< 40	1.4J
VANADIUM	SW6010B	mg/kg	5	45.8	36.7	30.7	54.2
ZINC	SW6010B	mg/kg	2	97.8	116	123	267

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS02CH46-208 03-03651-5	RBS02CH53-212 03-03651-6	RBS02CH60-216 03-03651-7	RBS02CH66-202 03-03651-8
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS02CH46-208 03-03651-5	RBS02CH53-212 03-03651-6	RBS02CH60-216 03-03651-7	RBS02CH66-202 03-03651-8
METALS, TOTAL							
Dilution Factor				4	4	4	4
ALUMINUM	SW6010B	mg/kg	50	4,440	8,720	6,780	4,940
ANTIMONY	SW6010B	mg/kg	10	< 40	< 40	< 40	< 40
ARSENIC	SW6010B	mg/kg	10	11.1J	15.8J	29.4J	18.8J
BARIUM	SW6010B	mg/kg	10	1,860	1,230	931	1,220
BERYLLIUM	SW6010B	mg/kg	0.5	< 2	< 2	< 2	< 2
CADMIUM	SW6010B	mg/kg	0.5	0.11J	0.18J	0.34J	0.35J
CALCIUM	SW6010B	mg/kg	100	298J	706	1,000	279J
CHROMIUM	SW6010B	mg/kg	5	5.2J	10.3J	12.2J	7.7J
COBALT	SW6010B	mg/kg	5	14.6J	26.9	17.8J	18.7J
COPPER	SW6010B	mg/kg	5	197	207	111	212
Dilution Factor				4	20	20	20
IRON	SW6010B	mg/kg	10	20,700	81,500	59,300	54,300
Dilution Factor				4	4	4	4
LEAD	SW6010B	mg/kg	1	19.5	48.2	36.8	33.6
MAGNESIUM	SW6010B	mg/kg	50	752	1,400	948	782
Dilution Factor				20	20	20	20
MANGANESE	SW6010B	mg/kg	2	16,200	18,700	11,900	14,300
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.043J	0.079J	0.065J	0.044J
Dilution Factor				4	4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	< 20	< 20	< 20	< 20
NICKEL	SW6010B	mg/kg	5	60.5	114	76.6	85.1
POTASSIUM	SW6010B	mg/kg	500	340J	1,020J	672J	663J
SELENIUM	SW6010B	mg/kg	5	10.5J	13.7J	8.0J	9.4J
SILVER	SW6010B	mg/kg	5	0.86J	0.41J	0.24J	0.28J
SODIUM	SW6010B	mg/kg	500	< 2000	< 2000	< 2000	< 2000
THALLIUM	SW6010B	mg/kg	10	1.9J	1.3J	< 40	< 40
VANADIUM	SW6010B	mg/kg	5	18.4J	42.2	31.5	28.6
ZINC	SW6010B	mg/kg	2	93.6	142	70.6	127

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02CH79-209 03-03651-9	RBS02CH92-200 03-03651-10	RBS02CH95-201 03-03651-11
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02CH79-209 03-03651-9	RBS02CH92-200 03-03651-10	RBS02CH95-201 03-03651-11
METALS, TOTAL						
Dilution Factor				4	4	4
ALUMINUM	SW6010B	mg/kg	50	4,340	9,820	7,930
ANTIMONY	SW6010B	mg/kg	10	< 40	< 40	< 40
ARSENIC	SW6010B	mg/kg	10	22.9J	31.8J	22.8J
BARIUM	SW6010B	mg/kg	10	908	2,630	2,520
BERYLLIUM	SW6010B	mg/kg	0.5	< 2	< 2	< 2
CADMIUM	SW6010B	mg/kg	0.5	0.34J	0.37J	0.38J
CALCIUM	SW6010B	mg/kg	100	334J	586	558
CHROMIUM	SW6010B	mg/kg	5	6.0J	11.6J	8.0J
COBALT	SW6010B	mg/kg	5	19.5J	42.7	22.1
COPPER	SW6010B	mg/kg	5	131	333	201
Dilution Factor				20	20	20
IRON	SW6010B	mg/kg	10	45,600	71,200	75,000
Dilution Factor				4	4	4
LEAD	SW6010B	mg/kg	1	31.7	54.0	48.1
MAGNESIUM	SW6010B	mg/kg	50	716	1,460	1,350
Dilution Factor				20	20	20
MANGANESE	SW6010B	mg/kg	2	11,100	19,200	22,200
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.029J	0.049J	0.035J
Dilution Factor				4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	< 20	< 20	< 20
NICKEL	SW6010B	mg/kg	5	55.9	118	87.6
POTASSIUM	SW6010B	mg/kg	500	539J	1,060J	823J
SELENIUM	SW6010B	mg/kg	5	6.8J	10.4J	12.1J
SILVER	SW6010B	mg/kg	5	0.088J	< 20	0.45J
SODIUM	SW6010B	mg/kg	500	< 2000	< 2000	< 2000
THALLIUM	SW6010B	mg/kg	10	< 40	0.95J	< 40
VANADIUM	SW6010B	mg/kg	5	24.3	37.4	43.3
ZINC	SW6010B	mg/kg	2	79.1	150	182

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02CH100-203 03-03651-12	RBS02CH112-213 03-03651-13	RBS02CH118-215 03-03651-14
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02CH100-203 03-03651-12	RBS02CH112-213 03-03651-13	RBS02CH118-215 03-03651-14
METALS, TOTAL						
Dilution Factor				4	4	4
ALUMINUM	SW6010B	mg/kg	50	6,710	6,200	4,280
ANTIMONY	SW6010B	mg/kg	10	< 40	< 40	< 40
ARSENIC	SW6010B	mg/kg	10	21.9J	22.3J	11.6J
BARIUM	SW6010B	mg/kg	10	1,810	2,280	925
BERYLLIUM	SW6010B	mg/kg	0.5	< 2	< 2	< 2
CADMIUM	SW6010B	mg/kg	0.5	0.41J	0.33J	0.13J
CALCIUM	SW6010B	mg/kg	100	344J	1,060	556
CHROMIUM	SW6010B	mg/kg	5	12.5J	8.9J	8.9J
COBALT	SW6010B	mg/kg	5	24.0	14.5J	10.8J
COPPER	SW6010B	mg/kg	5	295	215	115
Dilution Factor				20	20	4
IRON	SW6010B	mg/kg	10	61,300	63,300	29,400
Dilution Factor				4	4	4
LEAD	SW6010B	mg/kg	1	47.3	38.4	21.1
MAGNESIUM	SW6010B	mg/kg	50	810	1,030	516
Dilution Factor				20	20	20
MANGANESE	SW6010B	mg/kg	2	19,900	23,500	13,700
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.068J	0.055J	0.045J
Dilution Factor				4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	< 20	< 20	< 20
NICKEL	SW6010B	mg/kg	5	114	130	97.5
POTASSIUM	SW6010B	mg/kg	500	647J	710J	323J
SELENIUM	SW6010B	mg/kg	5	12.0J	14.9J	10J
SILVER	SW6010B	mg/kg	5	0.43J	0.47J	0.40J
SODIUM	SW6010B	mg/kg	500	< 2000	< 2000	< 2000
THALLIUM	SW6010B	mg/kg	10	1.4J	0.67J	1.5J
VANADIUM	SW6010B	mg/kg	5	34.8	44.2	20.5
ZINC	SW6010B	mg/kg	2	169	169	110

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02CH128-204 03-03651-15	RBS02CH145-214 03-03651-16	RBS02CH150-211 03-03651-17
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS02CH128-204 03-03651-15	RBS02CH145-214 03-03651-16	RBS02CH150-211 03-03651-17
METALS, TOTAL						
Dilution Factor				4	4	4
ALUMINUM	SW6010B	mg/kg	50	2,860	2,010	5,820
ANTIMONY	SW6010B	mg/kg	10	0.87J	0.62J	< 40
ARSENIC	SW6010B	mg/kg	10	12.1J	7.6J	12.5J
BARIUM	SW6010B	mg/kg	10	755	658	880
BERYLLIUM	SW6010B	mg/kg	0.5	0.15J	< 2	< 2
CADMIUM	SW6010B	mg/kg	0.5	0.25J	0.14J	0.065J
CALCIUM	SW6010B	mg/kg	100	657	423	542
CHROMIUM	SW6010B	mg/kg	5	3.1J	10.3J	10.3J
COBALT	SW6010B	mg/kg	5	5.4J	4.4J	22.1
COPPER	SW6010B	mg/kg	5	89.9	188	165
Dilution Factor				4	4	20
IRON	SW6010B	mg/kg	10	10,200	15,100	47,700
Dilution Factor				4	4	4
LEAD	SW6010B	mg/kg	1	8.8	17.9	32.3
MAGNESIUM	SW6010B	mg/kg	50	553	1,090	2,390
Dilution Factor				10	10	20
MANGANESE	SW6010B	mg/kg	2	7,980	7,800	12,900
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.059J	0.077J	0.049J
Dilution Factor				4	4	4
MOLYBDENUM	SW6010B	mg/kg	5	< 20	1.4J	< 20
NICKEL	SW6010B	mg/kg	5	43.0	67.3	111
POTASSIUM	SW6010B	mg/kg	500	178J	135J	496J
SELENIUM	SW6010B	mg/kg	5	5.8J	5.6J	8.5J
SILVER	SW6010B	mg/kg	5	0.52J	0.39J	0.52J
SODIUM	SW6010B	mg/kg	500	64.1J	65.9J	< 2000
THALLIUM	SW6010B	mg/kg	10	0.96J	1.1J	0.72J
VANADIUM	SW6010B	mg/kg	5	26.6	14.9J	27.0
ZINC	SW6010B	mg/kg	2	76.4	67.0	112

PQL: Practical Quantitation Limit. MDL: Method Detection Limit. CRDL: Contract Required Detection Limit

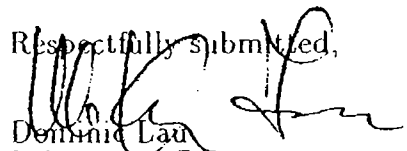
N.D.: Not Detected or less than the practical quantitation limit.

": Analysis is not required.

J: Reported between PQL and MDL.

Listed Dilution Factors (DF) are relative to the method default DF. All unlisted DFs are 1.0

Respectfully Submitted,


 Dennis Lau
 Laboratory Director
 Applied P & Ch Laboratory

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1 <input checked="" type="checkbox"/> & 3 Source 1
--------------------	---

PHAW Contact (Name and Phone Number)	Suman Sharma (925) 288-2332
--------------------------------------	-----------------------------

Name of Sampler:	JS/SS
------------------	-------

COOLER
TEMPERATURE:

3.4°C

COC #: 1031

Lab: APCL

Purchase Order No:

Cooler: 1 of 1

Courier Company:

Ship Date: 6/10/03

Courier No:

UPS

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO ₃	ice, NaOH/Zn Acetate	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE		
			Solid Preservative	ice	ice		
			Solid Container	8 oz jar	8 oz jar		
			Metals-Total ICP (EPA 6010B/7471A/7470A, SW-846)	Acid Soluble Sulfide (SW9030B, SW-846)	MATRIX		
Temperature Blank					A		One 40 mL in each cooler
RB S02 CH 150-211	6/10/03	0930	✓	✓	S/Rock		Rock Pulverization
RB S02 CH 153-212		0927	✓	✓	↓		↓
RB S02 CH 112-213		0932	✓	✓	↓		↓
RB S02 CH 145-214		0940	✓	✓	↓		↓
RB S02 CH 118-215		0942	✓	✓	↓		↓
RB S02 CH 60-216		0945	✓	✓	↓	✓	↓
RB S02 SS 05-217		0950	✓	✓	S		
RB S02 SS 100-218		1000	✓	✓	↓		
RB S02 SS 35-219		1005	✓	✓	↓		
RB S02 SS 65-220		1008	✓	✓	↓		
RB S02 SS 129-221		1015	✓	✓	↓		

AT → 48 hours rush on metals, 5-day rush on acid sulfides

Relinquished by: (Signature) mshwa	Date / Time 6/10/03 1400	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time 6/11/03 1000	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1 <u>2</u> & 3 Source 1
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler: JS / SS	

COOLER
TEMPERATURE:

3.4°C

COC #: 1030

Lab: APCL

Purchase Order No: _____

Cooler: 1 of 1

Courier Company: _____

Ship Date: 6/10/03

Courier No: UPS

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
Temperature Blank						A		One 40 mL in each cooler
RBS02CH92-200	6/10/03	0845		✓	✓	S/Rock		Rock Pulverization
RBS02CH95-201		0848						
RBS02CH66-202		0850						
RBS02CH100-203		0900						
RBS02CH128-204		0855						
RBS02CH12-205		0905						
RBS02CH42-206		0910						
RBS02CH16-207		0915						
RBS02CH46-208		0920						
RBS02CH79-209		0922						
RBS02CH22-210	✓	0925		✓	✓	✓		✓

TAT → 48 hours Rush on metals, 5-day rush on Acid Sulfide

Relinquished by: (Signature) Suman Sharma	Date / Time 6/10/03 / 400	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time 6/11/03 / 1100	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)



A P C L

Applied Physics & Chemistry Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel. (909) 590-1828 Fax (909) 590-1488

June 17, 2003

Shaw E & I

Attention: Suman Sharma
4005 Port Chicago Highway
Concord, CA 94520-1120

Dear Suman,

This package contains samples in our Service ID 03-3312 and your project 843812 EMAC Hunters Point.

Enclosed please find:

- (1) Original report.
- (2) Original Chain of Custody.
- (3) One original and one compact disk of Level C Data Package Deliverable.
- (4) One Diskette containing EDD Deliverable.

If anything is missing or you have any questions, please feel free to contact me.

Respectfully submitted,

Regina Kirakozova
Associate QA/QC Director
Applied P & Ch Laboratory

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel: (909) 590-1828 Fax: (909) 590-1498

Submitted to:

Shaw E & I

Attention: Suman Sharma

4005 Port Chicago Highway

Concord CA 94520-1120

Tel: (925) 288-9898 Fax: (925) 827-5927

APCL Analytical Report

Service ID #: 801-033312

Collected by:

Collected on: 05/19/03

Received: 05/20/03

Extracted: N/A

Tested: 05/20-06/02/03

Reported: 06/04/03

Sample Description: Soil and Water

Project Description: 843812 EMAC Hunters Point

Analysis of Water and Soil Samples

I. Analysis of Water Samples

Component Analyzed	Method	Unit	PQL	Analysis Result	
				RBS03EB1-334	03-03312-1
SULFIDE, ACID SOLUBLE	9030B	mg/L	10	< 10	
METALS, TOTAL				1	
Dilution Factor				58.1J	
ALUMINUM	SW6010B	µg/L	200	< 6	
ANTIMONY	SW6010B	µg/L	6	< 50	
ARSENIC	SW6010B	µg/L	50	1.4J	
BARIUM	SW6010B	µg/L	100	< 4	
BERYLLIUM	SW6010B	µg/L	4	< 5	
CADMIUM	SW6010B	µg/L	5	171J	
CALCIUM	SW6010B	µg/L	500	4.2J	
CHROMIUM	SW6010B	µg/L	10	< 10	
COBALT	SW6010B	µg/L	10	< 10	
COPPER	SW6010B	µg/L	10	26.0J	
IRON	SW6010B	µg/L	100	< 10	
LEAD	SW6010B	µg/L	10	169J	
MAGNESIUM	SW6010B	µg/L	500	2.5J	
MANGANESE	SW6010B	µg/L	10	0.12J	
MERCURY	SW7470A	µg/L	0.2	< 50	
MOLYBDENUM	SW6010B	µg/L	50	3.4J	
NICKEL	SW6010B	µg/L	20	122J	
POTASSIUM	SW6010B	µg/L	500	4.4J	
SELENIUM	SW6010B	µg/L	20	1.0J	
SILVER	SW6010B	µg/L	10	< 500	
SODIUM	SW6010B	µg/L	500	2.2J	
THALLIUM	SW6010B	µg/L	10	0.82J	
VANADIUM	SW6010B	µg/L	50	5.5J	
ZINC	SW6010B	µg/L	20		

II. Analysis of Soil Samples

Component Analyzed	Method	Unit	PQL	Analysis Result				
				RBS03SS002-318	RBS03SS010-324	RBS03SS022-329	RBS03SS038-322	
				03-03312-2	03-03312-3	03-03312-4	03-03312-5	
MOISTURE	ASTM-D2216	%Moisture	0.5	2.5	5.7	4.9	1.7	
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 110	< 110	< 100	

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03SS002-318 03-03312-2	RBS03SS010-324 03-03312-3	RBS03SS022-329 03-03312-4	RBS03SS038-322 03-03312-5

METALS, TOTAL

Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	10,700	15,300	7,780	1,740
ANTIMONY	SW6010B	mg/kg	10	<10	<11	<11	<10
ARSENIC	SW6010B	mg/kg	10	19.7	9.2J	10.4J	3.2J
BARIUM	SW6010B	mg/kg	10	1,160	692	638	173
BERYLLIUM	SW6010B	mg/kg	0.5	<0.51	<0.53	<0.53	0.13J
CADMIUM	SW6010B	mg/kg	0.5	0.32J	0.16J	0.093J	0.10J
CALCIUM	SW6010B	mg/kg	100	1,260	3,580	1,000	766
CHROMIUM	SW6010B	mg/kg	5	19.1	34.3	21.6	2.7J
COBALT	SW6010B	mg/kg	5	30.3	30.0	12.8	1.9J
COPPER	SW6010B	mg/kg	5	269	153	97.5	32.2
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	85,100	76,400	59,600	4,340
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	52.0	71.3	47.6	3.3
MAGNESIUM	SW6010B	mg/kg	50	2,560	6,310	1,360	385
Dilution Factor				20	10	10	10
MANGANESE	SW6010B	mg/kg	2	22,100	9,040	5,990	2,010
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.27	0.14J	0.099J	0.10J
MOLYBDENUM	SW6010B	mg/kg	5	<5.1	<5.3	<5.3	<5.1
NICKEL	SW6010B	mg/kg	5	101	62.3	29.4	14.6
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	1,200J	1,710J	1,470J	119J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	9.2	3.2J	3.3J	1.4J
SILVER	SW6010B	mg/kg	5	2.6J	1.2J	0.65J	0.29J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	<5100	<5300	<5300	<5100
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	<10	<11	<11	<10
VANADIUM	SW6010B	mg/kg	5	96.4	156	69.2	9.0
ZINC	SW6010B	mg/kg	2	146	140	56.8	12.5

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03SS039-323 03-03312-6	RBS03SS043-326 03-03312-7	RBS03SS052-330 03-03312-8	RBS03SS060-332 03-03312-9
MOISTURE	ASTM-D2216	%Moisture	0.5	8.9	6.9	1.7	3.8
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	<110	<110	<100	<100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03SS039-323 03-03312-6	RBS03SS043-326 03-03312-7	RBS03SS052-330 03-03312-8	RBS03SS060-332 03-03312-9
METALS, TOTAL							
Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	14,200	15,700	5,260	8,880
ANTIMONY	SW6010B	mg/kg	10	< 11	< 11	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	6.2J	9.1J	5.6J	9.2J
BARIUM	SW6010B	mg/kg	10	507	970	539	1,010
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.55	< 0.54	< 0.51	< 0.52
CADMIUM	SW6010B	mg/kg	0.5	0.13J	0.28J	0.14J	0.38J
CALCIUM	SW6010B	mg/kg	100	3,130	2,390	804	1,550
CHROMIUM	SW6010B	mg/kg	5	34.7	34.2	12.8	20.4
COBALT	SW6010B	mg/kg	5	23.9	26.6	9.8	19.6
COPPER	SW6010B	mg/kg	5	106	170	87.4	158
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	64,600	77,100	35,700	61,800
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	71.0	66.2	29.1	50.4
MAGNESIUM	SW6010B	mg/kg	50	5,080	4,760	927	2,170
Dilution Factor				10	10	10	10
MANGANESE	SW6010B	mg/kg	2	5,410	10,100	5,530	11,300
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.11J	0.13J	0.097J	0.28
MOLYBDENUM	SW6010B	mg/kg	5	< 5.5	< 5.4	< 5.1	< 5.2
NICKEL	SW6010B	mg/kg	5	50.4	63.9	23.7	68.2
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	1,310J	1,810J	944J	1,060J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	3.5J	2.7J	2.6J	6.4
SILVER	SW6010B	mg/kg	5	0.55J	1.0J	0.66J	1.4J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5500	< 5400	< 5100	< 5200
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	< 11	< 11	< 10	< 10
VANADIUM	SW6010B	mg/kg	5	112	125	40.0	86.7
ZINC	SW6010B	mg/kg	2	104	117	42.3	113

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03SS062-319 03-03312-10	RBS03SS063-320 03-03312-11	RBS03SS072-325 03-03312-12	RBS03SS074-327 03-03312-13
MOISTURE	ASTM-D2216	%Moisture	0.5	5.7	6.8	4.7	11.2
SULFIDE ACID SOLUBLE	9030B	mg/kg	100	< 110	< 110	< 100	< 110

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

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APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03SS062-319 03-03312-10	RBS03SS063-320 03-03312-11	RBS03SS072-325 03-03312-12	RBS03SS074-327 03-03312-13
METALS, TOTAL							
Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	16,800	14,500	16,300	13,300
ANTIMONY	SW6010B	mg/kg	10	< 11	< 11	< 10	< 11
ARSENIC	SW6010B	mg/kg	10	8.0J	7.7J	10.7	7.3J
BARIUM	SW6010B	mg/kg	10	495	430	1,320	480
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.53	< 0.54	< 0.52	< 0.56
CADMIUM	SW6010B	mg/kg	0.5	0.098J	0.040J	0.45J	0.062J
CALCIUM	SW6010B	mg/kg	100	3,190	3,610	2,690	2,340
CHROMIUM	SW6010B	mg/kg	5	37.4	38.2	34.4	28.8
COBALT	SW6010B	mg/kg	5	26.7	21.6	27.8	24.1
COPPER	SW6010B	mg/kg	5	111	93.6	162	107
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	63,000	71,300	88,500	61,100
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	93.7	77.6	71.6	50.2
MAGNESIUM	SW6010B	mg/kg	50	5,090	5,090	5,560	5,150
Dilution Factor				10	10	10	10
MANGANESE	SW6010B	mg/kg	2	8,070	8,490	11,100	5,570
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.20J	0.15J	0.11J	0.10J
MOLYBDENUM	SW6010B	mg/kg	5	< 5.3	< 5.4	< 5.2	< 5.6
NICKEL	SW6010B	mg/kg	5	69.6	56.3	61.8	45.4
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	1,250J	1,110J	2,020J	1,280J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	3.8J	2.6J	3.6J	1.8J
SILVER	SW6010B	mg/kg	5	0.88J	0.81J	1.5J	0.41J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5300	< 5400	< 5200	< 5600
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	< 11	< 11	< 10	< 11
VANADIUM	SW6010B	mg/kg	5	128	123	148	134
ZINC	SW6010B	mg/kg	2	135	112	126	106

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS03SS094-321 03-03312-14	RBS03SS134-328 03-03312-15	RBS03SS148-331 03-03312-16
MOISTURE	ASTM-D2216	%Moisture	0.5	6.0	3.0	4.4
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 110	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS03SS094-321 03-03312-14	RBS03SS134-328 03-03312-15	RBS03SS148-331 03-03312-16
METALS, TOTAL.						
Dilution Factor				1	1	1
ALUMINUM	SW6010B	mg/kg	50	16,000	4,200	3,780
ANTIMONY	SW6010B	mg/kg	10	< 11	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	7.5J	5.0J	3.2J
BARIUM	SW6010B	mg/kg	10	552	341	381
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.53	< 0.52	< 0.52
CADMIUM	SW6010B	mg/kg	0.5	0.19J	0.12J	0.15J
CALCIUM	SW6010B	mg/kg	100	3,790	1,240	1,560
CHROMIUM	SW6010B	mg/kg	5	38.3	16.1	9.0
COBALT	SW6010B	mg/kg	5	24.2	11.4	5.5
COPPER	SW6010B	mg/kg	5	114	77.2	38.6
Dilution Factor				10	10	10
IRON	SW6010B	mg/kg	10	58,500	29,500	20,100
Dilution Factor				1	1	1
LEAD	SW6010B	mg/kg	1	71.9	26.2	30.8
MAGNESIUM	SW6010B	mg/kg	50	6,300	1,550	1,000
Dilution Factor				10	10	10
MANGANESE	SW6010B	mg/kg	2	8,350	6,470	2,000
Dilution Factor				1	1	1
MERCURY	SW6010B	mg/kg	0.2	0.14J	0.079J	0.16J
MOLYBDENUM	SW6010B	mg/kg	5	< 5.3	< 5.2	< 5.2
NICKEL	SW6010B	mg/kg	5	71.7	34.9	13.6
Dilution Factor				10	10	10
POTASSIUM	SW6010B	mg/kg	500	1,280J	615J	800J
Dilution Factor				1	1	1
SELENIUM	SW6010B	mg/kg	5	2.7J	2.7J	1.0J
SILVER	SW6010B	mg/kg	5	1.1J	0.65J	0.12J
Dilution Factor				10	10	10
SODIUM	SW6010B	mg/kg	500	< 5300	< 5200	< 5200
Dilution Factor				1	1	1
THALLIUM	SW6010B	mg/kg	10	< 11	< 10	< 10
VANADIUM	SW6010B	mg/kg	5	137	45.6	20.1
ZINC	SW6010B	mg/kg	2	139	55.5	62.3

PQL: Practical Quantitation Limit.

MDL: Method Detection Limit.

CRDL: Contract Required Detection Limit

N.D.: Not Detected or less than the practical quantitation limit.

": Analysis is not required.

J: Reported between PQL and MDL.

† All results are reported on dry basis for soil samples.

Listed Dilution Factors (DF) are relative to the method default DF. All unlisted DFs are 1.0

Respectfully submitted,


 Dominic Lau
 Laboratory Director
 Applied P & Ch Laboratory

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler:	

COOLER TEMPERATURE: 4.1°C	COC #: 1021
Purchase Order No:	Lab: APCL
Courier Company: UPS	Cooler: 1 of 1
Courier No:	Ship Date: 5/19/03

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE		
			Solid Preservative	ice	ice	MATRIX	
			Solid Container	8 oz jar	8 oz jar		
Temperature Blank						A	One 40 mL in each cooler
RBS03BA 088-311	5/19/03	0940		✓	✓	S	Grid # 1
RBS03CH090-312		0943					
RBS03BA136-313		0948					
RBS03CH067-314		0950					
RBS03CH071-315		0955					
RBS03BA148-316		1005					
RBS03DS001-317		1010					
RBS03SS002-318		1040					Grid # 2
RBS03SS062-319		1042					
RBS03SS068-320		1045					
RBS03SS094-321		1048					

Relinquished by: (Signature) <i>[Signature]</i>	Date / Time 5/19/03 1500	Received by: (Signature) <i>[Signature]</i>	Relinquished by: (Signature)	Date / Time 5/20/03 1000	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler:	

COOLER TEMPERATURE:

3.4°C

COC #: 1022

Lab: APCL

Purchase Order No:

Courier Company:

Courier No:

Cooler: 1 of 1

Ship Date: 5/19/03

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
Temperature Blank	—	—				A		One 40 mL in each cooler
RBS03038-322	5/19/03	1050		✓	✓	S		Grid # 2
RBS03SS039-323		1052		✓	✓			Perham ms/msd
RBS03SS010-324		1055		✓	✓			
RBS03SS072-325		1058		✓	✓			
RBS03SS043-326		1100		✓	✓			
RBS03SS074-327		1103		✓	✓			
RBS03SS134-328		1105		✓	✓			
RBS03SS022-329		1107		✓	✓			
RBS03SS052-330		1110		✓	✓			
RBS03SS148-331		1112		✓	✓			
RBS03SS060-332	✓	1115		✓	✓			
RBS03EB1-334	5/19/03	1300		✓	✓	A		

Relinquished by: (Signature) <i>[Signature]</i>	Date / Time 5/19/03 1500	Received by: (Signature) <i>[Signature]</i>	Relinquished by: (Signature)	Date / Time 5/20/03 1000	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)



A P C L

Applied Physics & Chemistry Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel. (909) 590-1828 Fax (909) 590-1498

June 17, 2003

Shaw E & I

Attention: Suman Sharma
4005 Port Chicago Highway
Concord, CA 94520-1120

Dear Suman,

This package contains samples in our Service ID 03-3311 and your project 843812 EMAC Hunters Point.

Enclosed please find:

- (1) Original report.
- (2) Original Chain of Custody.
- (3) One original and one compact disk of Level C Data Package Deliverable.
- (4) One Diskette containing EDD Deliverable.

If anything is missing or you have any questions, please feel free to contact me.

Respectfully submitted,

Regina Kirakozova
Associate QA/QC Director
Applied P & Ch Laboratory

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel: (909) 590-1828 Fax: (909) 590-1498

Submitted to:

Shaw E & I

Attention: Suman Sharma

4005 Port Chicago Highway

Concord CA 94520-1120

Tel: (925) 288-9898 Fax: (925) 827-5927

APCL Analytical Report

Service ID #: 801-033311

Collected by:

Collected on: 05/19/03

Received: 05/20/03

Extracted: N/A

Tested: 05/21-06/02/03

Reported: 06/04/03

Sample Description: Rock from Regional Bedrock Site 1,2,3.

Project Description: 843812 EMAC Hunters Point

Analysis of Rock Samples

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03BA088-311 03-03311-1	RBS03BA109-304 03-03311-2	RBS03BA113-305 03-03311-3	RBS03BA114-306 03-03311-4
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100
METALS, TOTAL							
Dilution Factor				10	10	10	20
ALUMINUM	SW6010B	mg/kg	50	21,800	19,400	32,500	35,600
Dilution Factor				1	1	1	1
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	19.9	1.3J	< 10	< 10
BARIUM	SW6010B	mg/kg	10	407	628	705	747
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	0.016J	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	965	1,160	1,400	2,040
CHROMIUM	SW6010B	mg/kg	5	47.3	36.3	38.1	37.0
COBALT	SW6010B	mg/kg	5	31.7	45.2	74.4	60.9
COPPER	SW6010B	mg/kg	5	159	119	157	174
Dilution Factor				10	10	10	20
IRON	SW6010B	mg/kg	10	78,700	63,400	86,300	103,000
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	24.0	9.3	11.7	18.2
MAGNESIUM	SW6010B	mg/kg	50	1,950	3,540	8,060	11,900
Dilution Factor				10	10	10	20
MANGANESE	SW6010B	mg/kg	2	7,000	7,400	8,110	9,010
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.16J	0.081J	0.073J	0.043J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	65.5	65.0	103	103
Dilution Factor				10	10	10	20
POTASSIUM	SW6010B	mg/kg	500	853J	619J	763J	647J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	1.9J	3.8J	3.5J	< 5
SILVER	SW6010B	mg/kg	5	1.2J	1.2J	1.6J	1.1J
Dilution Factor				10	10	10	20
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000	< 10000
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
VANADIUM	SW6010B	mg/kg	5	332	254	339	356
ZINC	SW6010B	mg/kg	2	36.0	147	169	166

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03BA119-309	RBS03BA119-310	RBS03BA136-313	RBS03BA143-316
				03-03311-5	03-03311-6	03-03311-7	03-03311-8
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100
METALS, TOTAL							
Dilution Factor				10	10	10	10
ALUMINUM	SW6010B	mg/kg	50	21,500	20,200	16,900	28,600
Dilution Factor				1	1	1	1
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	7.2J	6.8J	4.1J	20.0
BARIUM	SW6010B	mg/kg	10	565	543	296	396
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	1,380	1,170	1,120	1,250
CHROMIUM	SW6010B	mg/kg	5	69.6	77.1	30.8	65.1
COBALT	SW6010B	mg/kg	5	35.1	37.0	44.5	53.4
COPPER	SW6010B	mg/kg	5	173	169	257	173
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	84,900	70,600	87,200	86,900
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	13.8	12.9	24.1	23.9
MAGNESIUM	SW6010B	mg/kg	50	3,290	3,030	3,380	2,970
Dilution Factor				10	10	10	10
MANGANESE	SW6010B	mg/kg	2	4,650	4,860	5,320	6,220
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.21	0.16J	0.21	0.19J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	59.3	59.4	53.0	65.2
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	917J	756J	902J	1,200J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	< 5	2.0J	< 5	0.36J
SILVER	SW6010B	mg/kg	5	0.72J	0.78J	0.60J	0.61J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000	< 5000
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
VANADIUM	SW6010B	mg/kg	5	270	225	133	156
ZINC	SW6010B	mg/kg	2	130	76.7	48.6	68.0

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS03CH002-300	RBS03CH002-301	RBS03CH039-302	RBS03CH042-307
				03-03311-9	03-03311-10	03-03311-11	03-03311-12
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100

APCL Analytical Report

Analysis Result

Component Analyzed	Method	Unit	PQL	RBS03CH002-300 03-03311-9	RBS03CH002-301 03-03311-10	RBS03CH039-302 03-03311-11	RBS03CH042-307 03-03311-12
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METALS, TOTAL

Dilution Factor				10	10	10	10
ALUMINUM	SW6010B	mg/kg	50	4,850	5,140	24,600	32,600
Dilution Factor				1	1	1	1
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	7.8J	16.8	31.4	34.2
BARIUM	SW6010B	mg/kg	10	238	563	487	446
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	0.052J	0.17J	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	221	391	964	1,060
CHROMIUM	SW6010B	mg/kg	5	10.9	11.6	56.0	64.4
COBALT	SW6010B	mg/kg	5	9.3	12.6	35.7	27.4
COPPER	SW6010B	mg/kg	5	61.8	119	158	139
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	19,100	41,300	81,400	73,300
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	10.9	35.8	33.0	28.2
MAGNESIUM	SW6010B	mg/kg	50	388	679	1,760	2,200
Dilution Factor				10	10	10	10
MANGANESE	SW6010B	mg/kg	2	4,120	9,620	9,020	6,970
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.038J	0.073J	0.37	0.31
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	23.2	42.8	70.1	75.0
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	156J	181J	781J	1,120J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	2.6J	5.3	2.7J	1.8J
SILVER	SW6010B	mg/kg	5	0.55J	1.3J	1.2J	0.76J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000	< 5000
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
VANADIUM	SW6010B	mg/kg	5	36.3	70.2	158	152
ZINC	SW6010B	mg/kg	2	9.0	18.9	34.8	38.7

Analysis Result

Component Analyzed	Method	Unit	PQL	RBS03CH044-308 03-03311-13	RBS03CH067-314 03-03311-14	RBS03CH071-315 03-03311-15
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS03CH044-308 03-03311-13	RBS03CH067-314 03-03311-14	RBS03CH071-315 03-03311-15
METALS, TOTAL						
Dilution Factor				10	10	10
ALUMINUM	SW6010B	mg/kg	50	22,000	9,190	25,800
Dilution Factor				1	1	1
ANTIMONY	SW6010B	mg/kg	10	<10	<10	<10
ARSENIC	SW6010B	mg/kg	10	29.1	4.8J	27.2
BARIUM	SW6010B	mg/kg	10	633	139	570
BERYLLIUM	SW6010B	mg/kg	0.5	<0.5	<0.5	<0.5
CADMIUM	SW6010B	mg/kg	0.5	<0.5	<0.5	<0.5
CALCIUM	SW6010B	mg/kg	100	973	837	1,100
CHROMIUM	SW6010B	mg/kg	5	38.1	24.7	53.4
COBALT	SW6010B	mg/kg	5	19.7	17.7	39.4
COPPER	SW6010B	mg/kg	5	178	188	198
Dilution Factor				10	10	10
IRON	SW6010B	mg/kg	10	77,600	92,500	86,400
Dilution Factor				1	1	1
LEAD	SW6010B	mg/kg	1	35.1	24.7	28.1
MAGNESIUM	SW6010B	mg/kg	50	1,820	2,680	2,650
Dilution Factor				10	10	10
MANGANESE	SW6010B	mg/kg	2	10,300	4,450	7,730
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.26	0.031J	0.17J
MOLYBDENUM	SW6010B	mg/kg	5	<5	<5	<5
NICKEL	SW6010B	mg/kg	5	82.7	49.3	69.9
Dilution Factor				10	10	10
POTASSIUM	SW6010B	mg/kg	500	868J	575J	1,110J
Dilution Factor				1	1	1
SELENIUM	SW6010B	mg/kg	5	4.8J	<5	2.1J
SILVER	SW6010B	mg/kg	5	1.2J	0.15J	0.63J
Dilution Factor				10	10	10
SODIUM	SW6010B	mg/kg	500	<5000	<5000	<5000
Dilution Factor				1	1	1
THALLIUM	SW6010B	mg/kg	10	<10	<10	<10
VANADIUM	SW6010B	mg/kg	5	141	90.6	141
ZINC	SW6010B	mg/kg	2	41.8	42.4	47.3

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS03CH074-303 03-03311-16	RBS03CH090-312 03-03311-17	RBS03DS001-317 03-03311-18
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS03CH074-303 03-03311-16	RBS03CH090-312 03-03311-17	RBS03DS001-317 03-03311-18
METALS, TOTAL						
Dilution Factor				20	20	10
ALUMINUM	SW6010B	mg/kg	50	22,700	18,500	14,400
Dilution Factor				1	1	1
ANTIMONY	SW6010B	mg/kg	10	< 10	0.31J	0.84J
ARSENIC	SW6010B	mg/kg	10	9.7J	7.8J	5.6J
BARIUM	SW6010B	mg/kg	10	409	663	239
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	1,130	1,240	1,550
CHROMIUM	SW6010B	mg/kg	5	43.5	47.3	40.0
COBALT	SW6010B	mg/kg	5	50.3	31.3	28.1
COPPER	SW6010B	mg/kg	5	147	174	119
Dilution Factor				20	20	40
IRON	SW6010B	mg/kg	10	110,000	127,000	203,000
Dilution Factor				1	1	1
LEAD	SW6010B	mg/kg	1	21.6	32.8	49.1
MAGNESIUM	SW6010B	mg/kg	50	2,360	2,170	1,630
Dilution Factor				20	20	10
MANGANESE	SW6010B	mg/kg	2	8,710	7,710	4,330
Dilution Factor				1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.10J	0.071J	0.17J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	62.5	60.8	45.6
Dilution Factor				20	20	10
POTASSIUM	SW6010B	mg/kg	500	1,060J	1,370J	1,890J
Dilution Factor				1	1	1
SELENIUM	SW6010B	mg/kg	5	0.35J	< 5	< 5
SILVER	SW6010B	mg/kg	5	1.2J	0.90J	< 5
Dilution Factor				20	20	10
SODIUM	SW6010B	mg/kg	500	< 10000	< 10000	< 5000
Dilution Factor				1	1	1
THALLIUM	SW6010B	mg/kg	10	< 10	< 10	< 10
VANADIUM	SW6010B	mg/kg	5	241	178	122
ZINC	SW6010B	mg/kg	2	53.3	40.7	38.0

PQL: Practical Quantitation Limit. MDL: Method Detection Limit. CRDL: Contract Required Detection Limit

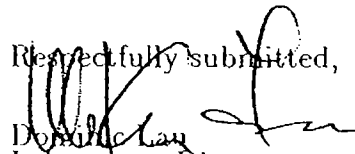
N.D.: Not Detected or less than the practical quantitation limit.

": Analysis is not required.

J: Reported between PQL and MDL.

Listed Dilution Factors (DF) are relative to the method default DF. All unlisted DFs are 1.0

Respectfully submitted,


 Don McLean
 Laboratory Director
 Applied P & Ch Laboratory

Chain Of Custody

IOJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
IAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
me of Sampler:	

COOLER
TEMPERATURE:

4.1°C

COC #: 1021

Lab: APCL

Purchase Order No:

Courier Company:

UPS

Courier No:

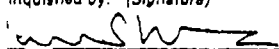
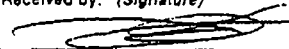
Cooler: 1 of 1

Ship Date: 5/19/03

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
Temperature Blank	—	—				A		One 40 mL in each cooler
RBSo3BA 088-311	5/19/03	0940		✓	✓	S		Grid # 1
RBSo3CH090-312		0943						
RBSo3BA136-313		0948						
RBSo3CH067-314		0950						
RBSo3CH071-315		0955						
RBSo3BA143-316		1005						
RBSo3DS001-317		1010						
RBSo3SS002-318		1040						
RBSo3SS062-319		1042						
RBSo3SS063-320		1045						
RBSo3SS094-321		1048						

3311

Grid # 2

Inquired by: (Signature) 	Date / Time 5/19/03 1500	Received by: (Signature) 	Relinquished by: (Signature)	Date / Time 5/20/03 1000	Received by: (Signature)
Inquired by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Inquired by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Chain Of Custody

ROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
HAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler:	

COOLER
TEMPERATURE:

39°C

COC #: 1020

Lab: APCL

Purchase Order No:

Courier Company:

Courier No:

UPS

Cooler: 1 of 1

Ship Date: 5/19/03

Aqueous Preservative			ice, HNO3	ice, NaOH/Zn Acetate	Aqueous (A)	Check if MS/MSD (requires double volume)	COMMENTS
Aqueous Container			1x0.5L PE	1x0.5L PE			
Solid Preservative			ice	ice			
Solid Container			8 oz jar	8 oz jar			
Sample ID	Sample Date mm/dd/yy	Sample Time	Metals-Total ICP (EPA 6010B/7471A/7470A, SW-846)	Acid Soluble Sulfide (SW9030B, SW-846)	MATRIX		
temperature Blank	—	—			A		One 40 mL in each cooler
RBSo3 CH002-300	5/19/03	0915	✓	✓	Soil		Grid #1
RBSo3 CH002-301		0940	✓	✓			
RBSo3 CH039-302		0920	✓	✓			
RBSo3 CH074-303		0922	✓	✓			
RBSo3 BA109-304		0925	✓	✓			
RBSo3 BA113-305		0928	✓	✓			Perform ms/msd
RBSo3 BA114-306		0930	✓	✓			
RBSo3 CH042-307		0932	✓	✓			3311
RBSo3 CH044-308		0935	✓	✓			
RBSo3 BA119-309		0938	✓	✓			
RBSo3 BA119-310	✓	1000	✓	✓	✓		✓

Relinquished by: (Signature) <i>[Signature]</i>	Date / Time 5/19/03 1500	Received by: (Signature) <i>[Signature]</i>	Relinquished by: (Signature)	Date / Time 5/20/03 1000	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)



A P C L

Applied Physics & Chemistry Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel. (909) 590-1525 Fax (909) 590-1495

June 17, 2003

Shaw E & I

Attention: Suman Sharma
4005 Port Chicago Highway
Concord CA 94520-1120

Dear Suman,

This package contains samples in our Service ID 03-2857 and your project EMAC-Hunters Point.
Enclosed please find:

- (1) Original Analytical Report.
- (2) Original Chain of Custody.
- (3) One Original and one compact disc of Level C Data Package Deliverable.
- (4) One diskette containing EDD deliverables.

If anything is missing or you have any questions, please feel free to contact me.

Respectfully submitted,

Regina Kirakozova
Associate QA/QC Director
Applied P & Ch Laboratory

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel: (909) 590-1828 Fax: (909) 590-1498

Submitted to:

Shaw E & I

Attention: Suman Sharma

4005 Port Chicago Highway

Concord CA 94520-1120

Tel (925) 288-9898 Fax: (925) 827-5927

APCL Analytical Report

Service ID #: 801-032857

Collected by: SS/RD

Collected on: 04/22/03

Received: 04/24/03

Extracted: N/A

Tested: 04/25-06/04/03

Reported: 06/05/03

Sample Description: Soil and Water

Project Description: 843812 EMAC-Hunters Point

Analysis of Water and Soil Samples

I. Analysis of Water Samples

Component Analyzed	Method	Unit	PQL	Analysis Result	
				RBS01SB001 03-02857-14	RBS01EB01 03-02857-17
SULFIDE, ACID SOLUBLE	9030B	mg/L	10	< 10	< 10
METALS, TOTAL					
Dilution Factor				1	1
ALUMINUM	SW6010B	µg/L	200	22.2J	44.7J
ANTIMONY	SW6010B	µg/L	6	< 6	< 6
ARSENIC	SW6010B	µg/L	50	< 50	< 50
BARIUM	SW6010B	µg/L	100	< 100	< 100
BERYLLIUM	SW6010B	µg/L	4	< 4	< 4
CADMIUM	SW6010B	µg/L	5	< 5	< 5
CALCIUM	SW6010B	µg/L	500	< 500	< 500
CHROMIUM	SW6010B	µg/L	10	1.9J	2.3J
COBALT	SW6010B	µg/L	10	< 10	< 10
COPPER	SW6010B	µg/L	10	< 10	< 10
IRON	SW6010B	µg/L	100	7.1J	15.5J
LEAD	SW6010B	µg/L	10	< 10	< 10
MAGNESIUM	SW6010B	µg/L	500	30.9J	31.7J
MANGANESE	SW6010B	µg/L	10	< 10	< 10
MERCURY	SW7470A	µg/L	0.2	0.19J	0.16J
MOLYBDENUM	SW6010B	µg/L	50	< 50	< 50
NICKEL	SW6010B	µg/L	20	< 20	1.3J
POTASSIUM	SW6010B	µg/L	500	81.9J	86.9J
SELENIUM	SW6010B	µg/L	20	< 20	< 20
SILVER	SW6010B	µg/L	10	< 10	< 10
SODIUM	SW6010B	µg/L	500	< 500	< 500
THALLIUM	SW6010B	µg/L	10	< 10	< 10
VANADIUM	SW6010B	µg/L	50	< 50	< 50
ZINC	SW6010B	µg/L	20	1.7J	< 20

II. Analysis of Soil Samples

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SS34 03-02857-1	RBS01SS33 03-02857-2	RBS01SS21 03-02857-3	RBS01SS22 03-02857-4
MOISTURE	ASTM-D2216	%Moisture	0.5	23.8	20.3	17.7	25.1
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 130	< 130	< 120	< 130

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SS34 03-02857-1	RBS01SS33 03-02857-2	RBS01SS21 03-02857-3	RBS01SS22 03-02857-4

METALS, TOTAL

Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	7,350	6,660	4,850	5,940
ANTIMONY	SW6010B	mg/kg	10	<13	<13	<12	<13
ARSENIC	SW6010B	mg/kg	10	3.0J	2.8J	2.6J	2.9J
BARIUM	SW6010B	mg/kg	10	54.0	41.6	33.3	37.0
BERYLLIUM	SW6010B	mg/kg	0.5	<0.66	<0.63	<0.61	<0.67
CADMIUM	SW6010B	mg/kg	0.5	<0.66	<0.63	<0.61	<0.67
CALCIUM	SW6010B	mg/kg	100	3,260	3,500	1,660	2,450
CHROMIUM	SW6010B	mg/kg	5	675	592	642	646
COBALT	SW6010B	mg/kg	5	117	96.2	99.8	106
COPPER	SW6010B	mg/kg	5	31.6	26.7	24.7	28.0
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	66,300	56,300	58,800	62,300
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	95.0	75.5	69.8	84.9
Dilution Factor				10	10	10	10
MAGNESIUM	SW6010B	mg/kg	50	116,000	133,000	117,000	123,000
Dilution Factor				1	1	1	1
MANGANESE	SW6010B	mg/kg	2	1,170	1,080	903	992
MERCURY	SW7471A	mg/kg	0.2	0.35	0.60	0.32	0.25J
MOLYBDENUM	SW6010B	mg/kg	5	<6.6	<6.3	<6.1	<6.7
NICKEL	SW6010B	mg/kg	5	1,720	1,610	1,780	1,900
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	796J	614J	514J	546J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	2.2J	1.4J	1.4J	2.2J
SILVER	SW6010B	mg/kg	5	0.12J	0.10J	0.086J	0.12J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	<6600	<6300	<6100	<6700
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	<13	0.21J	0.37J	1.2J
VANADIUM	SW6010B	mg/kg	5	35.9	34.3	27.8	31.1
ZINC	SW6010B	mg/kg	2	113	95.3	87.4	104

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SS23 03-02857-5	RBS01SS24 03-02857-6	RBS01SS25 03-02857-7	RBS01SS27 03-02857-8
MOISTURE	ASTM-D2216	%Moisture	0.5	16.4	14.7	23.1	30.2
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	<120	<120	<130	<140

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SS23 03-02857-5	RBS01SS24 03-02857-6	RBS01SS25 03-02857-7	RBS01SS27 03-02857-8

METALS, TOTAL

Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	3,120	2,770	9,180	7,840
ANTIMONY	SW6010B	mg/kg	10	< 12	< 12	< 13	< 14
ARSENIC	SW6010B	mg/kg	10	2.3J	1.5J	3.7J	3.3J
BARIUM	SW6010B	mg/kg	10	21.8	15.6	63.6	62.5
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.60	< 0.59	< 0.65	< 0.72
CADMIUM	SW6010B	mg/kg	0.5	< 0.60	< 0.59	< 0.65	< 0.72
CALCIUM	SW6010B	mg/kg	100	945	606	4,240	1,820
CHROMIUM	SW6010B	mg/kg	5	420	548	744	690
COBALT	SW6010B	mg/kg	5	92.0	96.6	116	131
COPPER	SW6010B	mg/kg	5	14.1	9.4	37.0	21.4
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	52,100	50,500	67,500	61,500
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	34.4	13.8	111	33.8
Dilution Factor				10	10	10	10
MAGNESIUM	SW6010B	mg/kg	50	158,000	174,000	97,800	155,000
Dilution Factor				1	1	1	10
MANGANESE	SW6010B	mg/kg	2	1,070	995	1,230	3,130
Dilution Factor				1	1	1	1
MERCURY	SW7471A	mg/kg	0.2	0.087J	0.086J	0.22J	0.25J
MOLYBDENUM	SW6010B	mg/kg	5	< 6.0	< 5.9	< 6.5	< 7.2
NICKEL	SW6010B	mg/kg	5	1,520	1,690	1,610	2,120
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	332J	275J	871J	586J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	0.85J	1.9J	3.3J	3.3J
SILVER	SW6010B	mg/kg	5	0.13J	0.13J	0.12J	0.26J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 6000	< 5900	< 6500	< 7200
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	1.5J	1.8J	< 13	0.94J
VANADIUM	SW6010B	mg/kg	5	25.2	28.8	43.6	30.0
ZINC	SW6010B	mg/kg	2	50.2	37.3	123	60.3

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SS28 03-02857-9	RBS01SS29 03-02857-10	RBS01SS30 03-02857-11	RBS01SS31 03-02857-12
MOISTURE	ASTM-D2216	%Moisture	0.5	15.6	22.6	17.7	25.2
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 120	< 130	< 120	< 130

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SS28 03-02857-9	RBS01SS29 03-02857-10	RBS01SS30 03-02857-11	RBS01SS31 03-02857-12
METALS, TOTAL							
Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	2,930	4,190	3,530	5,680
ANTIMONY	SW6010B	mg/kg	10	< 12	< 13	< 12	< 13
ARSENIC	SW6010B	mg/kg	10	1.9J	2.0J	2.0J	3.0J
BARIUM	SW6010B	mg/kg	10	20.8	31.4	26.7	48.5
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.59	< 0.65	< 0.61	< 0.67
CADMIUM	SW6010B	mg/kg	0.5	< 0.59	< 0.65	< 0.61	< 0.67
CALCIUM	SW6010B	mg/kg	100	958	1,450	1,170	2,340
CHROMIUM	SW6010B	mg/kg	5	484	540	533	618
COBALT	SW6010B	mg/kg	5	104	108	93.2	110
COPPER	SW6010B	mg/kg	5	16.1	23.0	18.4	33.8
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	45,700	56,900	51,300	61,500
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	28.3	66.5	38.3	125
Dilution Factor				10	10	10	10
MAGNESIUM	SW6010B	mg/kg	50	157,000	147,000	142,000	116,000
Dilution Factor				1	1	1	1
MANGANESE	SW6010B	mg/kg	2	987	953	812	1,050
MERCURY	SW7471A	mg/kg	0.2	0.088J	0.23J	0.11J	0.22J
MOLYBDENUM	SW6010B	mg/kg	5	< 5.9	< 6.5	< 6.1	< 6.7
NICKEL	SW6010B	mg/kg	5	1,570	1,840	1,670	1,820
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	318J	450J	619J	730J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	2.2J	2.1J	1.9J	3.3J
SILVER	SW6010B	mg/kg	5	0.096J	0.13J	0.088J	0.21J
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5900	< 6500	< 6100	< 6700
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	1.2J	0.32J	0.75J	0.21J
VANADIUM	SW6010B	mg/kg	5	25.9	27.9	26.5	30.8
ZINC	SW6010B	mg/kg	2	52.0	84.0	68.9	122

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS01SS32 03-02857-13	RBS01SS36 03-02857-15	RBS01SS35 03-02857-16
MOISTURE	ASTM-D2216	%Moisture	0.5	16.8	26.9	24.9
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	<120	<140	<130

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS01SS32 03-02857-13	RBS01SS36 03-02857-15	RBS01SS35 03-02857-16
METALS, TOTAL						
Dilution Factor				1	1	1
ALUMINUM	SW6010B	mg/kg	50	3,370	8,500	7,750
ANTIMONY	SW6010B	mg/kg	10	< 12	< 14	< 13
ARSENIC	SW6010B	mg/kg	10	2.3J	2.4J	2.9J
BARIUM	SW6010B	mg/kg	10	13.4	63.6	56.8
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.60	< 0.68	< 0.67
CADMIUM	SW6010B	mg/kg	0.5	< 0.60	< 0.68	< 0.67
CALCIUM	SW6010B	mg/kg	100	861	3,790	3,650
CHROMIUM	SW6010B	mg/kg	5	752	712	678
COBALT	SW6010B	mg/kg	5	83.3	120	122
COPPER	SW6010B	mg/kg	5	11.5	36.8	33.6
Dilution Factor				10	10	10
IRON	SW6010B	mg/kg	10	42,400	71,100	66,300
Dilution Factor				1	1	1
LEAD	SW6010B	mg/kg	1	23.0	115	110
Dilution Factor				10	10	10
MAGNESIUM	SW6010B	mg/kg	50	170,000	116,000	95,200
Dilution Factor				1	1	1
MANGANESE	SW6010B	mg/kg	2	842	1,280	1,190
MERCURY	SW7471A	mg/kg	0.2	0.094J	0.26J	0.46
MOLYBDENUM	SW6010B	mg/kg	5	< 6.0	< 6.8	< 6.7
NICKEL	SW6010B	mg/kg	5	1,460	1,620	1,810
Dilution Factor				10	10	10
POTASSIUM	SW6010B	mg/kg	500	282J	870J	899J
Dilution Factor				1	1	1
SELENIUM	SW6010B	mg/kg	5	1.9J	2.3J	2.5J
SILVER	SW6010B	mg/kg	5	0.17J	0.26J	0.23J
Dilution Factor				10	10	10
SODIUM	SW6010B	mg/kg	500	< 6000	< 6800	< 6700
Dilution Factor				1	1	1
THALLIUM	SW6010B	mg/kg	10	1.7J	< 14	< 13
VANADIUM	SW6010B	mg/kg	5	33.7	40.4	37.4
ZINC	SW6010B	mg/kg	2	37.8	124	115

PQL: Practical Quantitation Limit.

MDL: Method Detection Limit.

CRDL: Contract Required Detection Limit

N.D.: Not Detected or less than the practical quantitation limit.

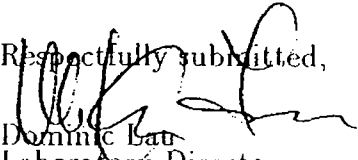
": Analysis is not required.

J: Reported between PQL and MDL.

} All results are reported on dry basis for soil samples.

Listed Dilution Factors (DF) are relative to the method default DF. All unlisted DFs are 1.0

Respectfully submitted,


 Dominic Lau
 Laboratory Director
 Applied P & Ch Laboratory

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler: Suman Sharma / Rich Dream	

COOLER TEMPERATURE: <div style="border: 1px solid black; padding: 2px; display: inline-block;">3.4, 4.2°C</div>	COC #: 1003
Purchase Order No:	Lab: APCL
Courier Company: UPS	Cooler: 1 of 2
Courier No: 1Z66 5450144198371	Ship Date: 4/23/03

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
Temperature Blank						A		One 40 mL in each cooler
RB S01 SP 12	4/22/03	0952		✓	✓	S		Grid Location 86
RB S01 SP 13		1010						150
RB S01 SP 14		1000						76
RB S01 SP 15		1005						63
RB S01 SP 16		1010						105
RB S01 SP 17		1015						109
RB S01 SS 21		1150						Grid Location 4
RB S01 SS 22		1200						100
RB S01 SS 23		1205						8
RB S01 SS 24		1207						9
RB S01 SS 25	✓	1209		✓	✓	✓		28

Relinquished by: (Signature) <i>Suman Sharma</i>	Date / Time 4/23/03 12:30	Received by: (Signature)	Relinquished by: (Signature)	Date / Time 4/24/03 8:30	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Chain Of Custody

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler: Suman Sharma / Rick Driscoll	

COOLER TEMPERATURE: 3.4, 4.2°C	COC #: 1004
Purchase Order No:	Lab: APCL
Courier Company: UPS	Cooler: 2 of 2
Courier No: 1Z66VS45014419837	Ship Date: 4/23/03



			Aqueous Preservative	ice, HNO ₃	ice, NaOH/Zn Acetate	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE		
			Solid Preservative	ice	ice		
			Solid Container	8 oz jar	8 oz jar		
Sample ID	Sample Date mm/dd/yy	Sample Time	Metals-Total ICP (EPA 6010B/7471A/7470A, SW-846)	Acid Soluble Sulfide (SW9030B, SW-846)	MATRIX		
Temperature Blank	—	—			A		One 40 mL in each cooler
RBS01 SP 26	4/22/03	1211	✓	✓	S	ms/msd	Grid location 145
RBS01 SS 27		1213					144
RBS01 SS 28		1215					38
RBS01 SS 29		1218					68
RBS01 SS 30		1220					69
RBS01 SS 31		1222					99
RBS01 SS 32		1224					103
RBS01 SS 33		1225					105
RBS01 SS 34		1230					50
RBS01 SS 35		1235					78
RBS01 SS 36	✓	1240	✓	✓	✓		86

Relinquished by: (Signature) <i>[Signature]</i>	Date / Time 4/23/03 1430	Received by: (Signature)	Relinquished by: (Signature)	Date / Time 4/24/03 0930	Received by: (Signature) <i>[Signature]</i>
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

PROJ NO. 843812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
SHAW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler: Suman Sharma / Rick Dragoon	

COOLER TEMPERATURE:	3.4, 4.2°C	COC #:	1005
Purchase Order No:		Lab:	APCL
Courier Company:	UPS	Cooler:	2 of 2
Courier No:	1266 V545014419032	Ship Date:	4/23/03

[illegible]

Relinquished by: (Signature) 	Date / Time 7/23/03 8:30	Received by: (Signature)	Relinquished by: (Signature)	Date / Time 4/24/03 8:30	Received by: (Signature) 
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)



APCL

Applied Physics & Chemistry Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel. (909) 590-1826 Fax (909) 590-1498

June 17, 2003

Shaw E & I

Attention: Suman Sharma
4005 Port Chicago Highway
Concord CA 94520-1120

Dear Suman,

This package contains samples in our Service ID 03-2856 and your project EMAC-Hunters Point.
Enclosed please find:

- (1) Original Analytical Report.
- (2) Original Chain of Custody.
- (3) One Original and one compact disc of Level C Data Package Deliverable.
- (4) One diskette containing EDD deliverables.

If anything is missing or you have any questions, please feel free to contact me.

Respectfully submitted,

Regina Kirakozova
Associate QA/QC Director
Applied P & Ch Laboratory

Applied P & Ch Laboratory

13760 Magnolia Ave. Chino CA 91710

Tel: (909) 590-1828 Fax: (909) 590-1498

Submitted to:

Shaw E & I

Attention: Surman Sharma

4005 Port Chicago Highway

Concord CA 94520-1120

Tel: (925) 288-9898 Fax: (925) 827-5927

APCL Analytical Report

Service ID #: 801-032856

Collected by: SS/RD

Collected on: 04/22/03

Received: 04/24/03

Extracted: N/A

Tested: 04/26-06/02/03

Reported: 06/04/03

Sample Description: Rocks

Project Description: 843812 EMAC-Hunters Point

Analysis of Rock Samples

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SP01 03-02856-1	RBS01SP02 03-02856-2	RBS01SP03 03-02856-3	RBS01SP04 03-02856-4
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100
METALS, TOTAL							
Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	1,430	1,540	1,560	1,800
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	0.79J	0.96J	0.79J	1.1J
BARIUM	SW6010B	mg/kg	10	1.3J	3.4J	3.4J	7.6J
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	61.8J	157	144	419
CHROMIUM	SW6010B	mg/kg	5	614	642	571	516
COBALT	SW6010B	mg/kg	5	85.1	78.9	86.1	77.0
COPPER	SW6010B	mg/kg	5	4.6J	5.3	2.6J	13.1
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	45,900	40,700	45,600	40,700
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	< 1	3.6	7.9	31.7
Dilution Factor				10	10	10	10
MAGNESIUM	SW6010B	mg/kg	50	210,000	198,000	196,000	172,000
Dilution Factor				1	1	1	1
MANGANESE	SW6010B	mg/kg	2	547	531	666	826
MERCURY	SW7471A	mg/kg	0.2	0.015J	0.011J	0.011J	0.12J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	1,710	1,620	1,550	1,190
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	74.1J	89.0J	100J	155J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	1.3J	0.49J	0.18J	0.78J
SILVER	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000	106J
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	2.7J	2.1J	2.9J	2.7J
VANADIUM	SW6010B	mg/kg	5	13.3	14.9	15.5	15.6
ZINC	SW6010B	mg/kg	2	20.5	23.7	32.5	51.7

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SP05 03-02856-5	RBS01SP06 03-02856-6	RBS01SP07 03-02856-7	RBS01SP08 03-02856-8
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100
METALS, TOTAL							
Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	2,100	861	1,280	1,460
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	0.86J	0.78J	0.78J	0.69J
BARIUM	SW6010B	mg/kg	10	2.1J	5.9J	7.5J	4.5J
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	84.3J	153	180	56.5J
CHROMIUM	SW6010B	mg/kg	5	332	192	72.9	645
COBALT	SW6010B	mg/kg	5	74.5	86.3	34.3	83.5
COPPER	SW6010B	mg/kg	5	6.3	9.9	4.6J	7.3
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	41,800	45,400	22,600	42,500
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	5.3	14.5	16.1	11.2
Dilution Factor				10	10	10	10
MAGNESIUM	SW6010B	mg/kg	50	192,000	191,000	165,000	196,000
Dilution Factor				1	1	1	1
MANGANESE	SW6010B	mg/kg	2	584	630	614	506
MERCURY	SW7471A	mg/kg	0.2	0.017J	0.069J	0.012J	0.021J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	1,260	1,690	499	1,520
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	81.0J	114J	115J	98.6J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	0.59J	< 5	0.41J	1.4J
SILVER	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000	< 5000
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	3.0J	2.3J	2.7J	2.6J
VANADIUM	SW6010B	mg/kg	5	13.7	6.3	5.0J	13.8
ZINC	SW6010B	mg/kg	2	22.3	30.8	32.4	26.7

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SP09 03-02856-9	RBS01SP10 03-02856-10	RBS01SP11 03-02856-11	RBS01SP12 03-02856-12
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result			
				RBS01SP09 03-02856-9	RBS01SP10 03-02856-10	RBS01SP11 03-02856-11	RBS01SP12 03-02856-12
METALS, TOTAL							
Dilution Factor				1	1	1	1
ALUMINUM	SW6010B	mg/kg	50	1,230	1,250	1,130	689
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	0.97J	1.0J	1.5J	0.46J
BARIUM	SW6010B	mg/kg	10	5.7J	5.3J	3.1J	1.0J
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	43.2J	91.4J	200	109
CHROMIUM	SW6010B	mg/kg	5	424	483	433	265
COBALT	SW6010B	mg/kg	5	82.2	78.0	82.1	97.4
COPPER	SW6010B	mg/kg	5	8.2	6.1	3.8J	3.1J
Dilution Factor				10	10	10	10
IRON	SW6010B	mg/kg	10	38,900	42,200	43,000	41,000
Dilution Factor				1	1	1	1
LEAD	SW6010B	mg/kg	1	10.9	14.4	7.8	0.19J
Dilution Factor				10	10	10	10
MAGNESIUM	SW6010B	mg/kg	50	184,000	181,000	186,000	175,000
Dilution Factor				1	1	1	1
MANGANESE	SW6010B	mg/kg	2	626	598	597	671
MERCURY	SW7471A	mg/kg	0.2	0.013J	0.019J	0.019J	0.15J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	1,560	1,570	1,500	1,810
Dilution Factor				10	10	10	10
POTASSIUM	SW6010B	mg/kg	500	109J	94.5J	91.6J	67.1J
Dilution Factor				1	1	1	1
SELENIUM	SW6010B	mg/kg	5	0.50J	0.95J	0.32J	0.61J
SILVER	SW6010B	mg/kg	5	< 5	< 5	< 5	< 5
Dilution Factor				10	10	10	10
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000	< 5000
Dilution Factor				1	1	1	1
THALLIUM	SW6010B	mg/kg	10	3.0J	2.5J	2.2J	3.0J
VANADIUM	SW6010B	mg/kg	5	11.2	13.5	13.1	8.5
ZINC	SW6010B	mg/kg	2	30.3	34.6	27.5	21.1

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS01SP13 03-02856-13	RBS01SP14 03-02856-14	RBS01SP15 03-02856-15
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS01SP13 03-02856-13	RBS01SP14 03-02856-14	RBS01SP15 03-02856-15
METALS, TOTAL						
Dilution Factor				1	1	1
ALUMINUM	SW6010B	mg/kg	50	917	1,280	742
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	0.46J
ARSENIC	SW6010B	mg/kg	10	1.2J	1.4J	0.59J
BARIUM	SW6010B	mg/kg	10	0.94J	11.4	5.0J
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	< 100	197	984
CHROMIUM	SW6010B	mg/kg	5	331	280	134
COBALT	SW6010B	mg/kg	5	86.7	70.4	89.7
COPPER	SW6010B	mg/kg	5	2.1J	16.6	11.1
Dilution Factor				10	10	10
IRON	SW6010B	mg/kg	10	48,100	39,100	45,100
Dilution Factor				1	1	1
LEAD	SW6010B	mg/kg	1	0.22J	36.1	5.2
Dilution Factor				10	10	10
MAGNESIUM	SW6010B	mg/kg	50	201,000	174,000	179,000
Dilution Factor				1	1	1
MANGANESE	SW6010B	mg/kg	2	680	618	686
MERCURY	SW7471A	mg/kg	0.2	0.015J	0.033J	0.11J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	1,910	1,340	1,570
Dilution Factor				10	10	10
POTASSIUM	SW6010B	mg/kg	500	64.1J	137J	174J
Dilution Factor				1	1	1
SELENIUM	SW6010B	mg/kg	5	0.54J	1.2J	1.4J
SILVER	SW6010B	mg/kg	5	< 5	< 5	< 5
Dilution Factor				10	10	10
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000
Dilution Factor				1	1	1
THALLIUM	SW6010B	mg/kg	10	2.7J	2.3J	2.6J
VANADIUM	SW6010B	mg/kg	5	10.6	9.7	4.0J
ZINC	SW6010B	mg/kg	2	20.6	50.9	24.6

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS01SP16 03-02856-16	RBS01SP17 03-02856-17	RBS01SP26 03-02856-18
SULFIDE, ACID SOLUBLE	9030B	mg/kg	100	< 100	< 100	< 100

APCL Analytical Report

Component Analyzed	Method	Unit	PQL	Analysis Result		
				RBS01SP16 03-02856-16	RBS01SP17 03-02856-17	RBS01SP26 03-02856-18
METALS, TOTAL						
Dilution Factor				1	1	1
ALUMINUM	SW6010B	mg/kg	50	850	743	1,460
ANTIMONY	SW6010B	mg/kg	10	< 10	< 10	< 10
ARSENIC	SW6010B	mg/kg	10	1.2J	1.3J	1.1J
BARIUM	SW6010B	mg/kg	10	4.0J	3.6J	1.8J
BERYLLIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5
CADMIUM	SW6010B	mg/kg	0.5	< 0.5	< 0.5	< 0.5
CALCIUM	SW6010B	mg/kg	100	87.4J	51.5J	200
CHROMIUM	SW6010B	mg/kg	5	223	307	509
COBALT	SW6010B	mg/kg	5	71.9	77.0	82.6
COPPER	SW6010B	mg/kg	5	7.2	4.7J	5.3
Dilution Factor				10	10	10
IRON	SW6010B	mg/kg	10	39,600	40,500	32,900
Dilution Factor				1	1	1
LEAD	SW6010B	mg/kg	1	5.5	1.7	1.2
Dilution Factor				10	10	10
MAGNESIUM	SW6010B	mg/kg	50	187,000	175,000	153,000
Dilution Factor				1	1	1
MANGANESE	SW6010B	mg/kg	2	522	655	522
MERCURY	SW7471A	mg/kg	0.2	0.020J	0.028J	0.031J
MOLYBDENUM	SW6010B	mg/kg	5	< 5	< 5	< 5
NICKEL	SW6010B	mg/kg	5	1,430	1,650	1,700
Dilution Factor				10	10	10
POTASSIUM	SW6010B	mg/kg	500	111J	68.6J	72.1J
Dilution Factor				1	1	1
SELENIUM	SW6010B	mg/kg	5	0.28J	0.51J	0.52J
SILVER	SW6010B	mg/kg	5	< 5	< 5	0.052J
Dilution Factor				10	10	10
SODIUM	SW6010B	mg/kg	500	< 5000	< 5000	< 5000
Dilution Factor				1	1	1
THALLIUM	SW6010B	mg/kg	10	2.7J	2.5J	1.6J
VANADIUM	SW6010B	mg/kg	5	6.1	6.7	15.6
ZINC	SW6010B	mg/kg	2	25.2	20.2	25.0

PQL: Practical Quantitation Limit. MDL: Method Detection Limit. CRDL: Contract Required Detection Limit

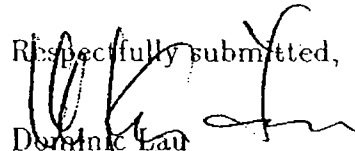
N.D.: Not Detected or less than the practical quantitation limit.

"-": Analysis is not required.

J: Reported between PQL and MDL.

Listed Dilution Factors (DF) are relative to the method default DF. All unlisted DFs are 1.0.

Respectfully submitted,


 Dominic Lau
 Laboratory Director
 Applied P & Ch Laboratory

Chain Of Custody

DJ NO. 43812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1	COOLER TEMPERATURE: <div style="border: 1px solid black; padding: 5px; display: inline-block;"> 3.4°C 4.2°C </div>	COC #: 1002 Lab: APCL
LW Contact (Name and Phone Number) Suman Sharma (925) 288-2332		Purchase Order No: _____ Courier Company: UPS	Cooler: 1 of 2 Ship Date: 4/23/03
is of Samplers Suman Sharma / Rick Orreson		Courier No: 1Z66V5450144 198371	

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
				Metals-Total ICP (EPA 6010B/7471A/7470A, SW-846)	Acid Soluble Sulfide (SW9030B, SW-846)			
Temperature Blank	4/22/03	—				A		One 40 mL in each cooler
2B S01 SP 01		0915		✓	✓	S		Grid Location 6
2B S01 SP 02		0917						9
2B S01 SP 03		0923						25
2B S01 SP 04		1000						100
2B S01 SP 05		0930						Grid Location 148
2B S01 SP 06		0938						138
2B S01 SP 07		0945						131
2B S01 SP 08		0948					ms/msd	91
2B S01 SP 09		0949						42
2B S01 SP 10		0953						49
2B S01 SP 11	✓	0955		✓	✓	✓		53

Relinquished by: (Signature) 	Date / Time 4/23/03 1430	Received by: (Signature) 	Relinquished by: (Signature) 	Date / Time 4/24/03 0930	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Chain Of Custody

OJ NO. 343812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
AW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Signature of Sampler: <i>Suman Sharma / Rich Dreesen</i>	

COOLER TEMPERATURE:

3.4, 4.2°C

COC #: 1003

Lab: APCL

Purchase Order No:

Courier Company: UPS

Courier No: 1266 5450144198371

Cooler: 1 of 2

Ship Date: 4/23/03

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
Temperature Blank						A		One 40 mL in each cooler
RB 501 SP 12	4/22/03	0952		✓	✓	S		Grid Location 86
RB 501 SP 13		1010						150
RB 501 SP 14		1000						76
RB 501 SP 15		1005						63
RB 501 SP 16		1010						105
RB 501 SP 17		1015						109
RB 501 SS 21		1150						Grid Location 4
RB 501 SS 22		1200						100
RB 501 SS 23		1205						8
RB 501 SS 24		1207						9
RB 501 SS 25	✓	1209		✓	✓	✓		✓ 28

2856

Inquired by: (Signature) <i>Suman Sharma</i>	Date / Time 4/23/03 1430	Received by: (Signature)	Relinquished by: (Signature)	Date / Time 4/24/03 830	Received by: (Signature) <i>[Signature]</i>
Inquired by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Inquired by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

Chain Of Custody

DJ NO. 143812	PROJECT NAME EMAC-Hunters Point: Regional Bedrock, Sites 1, 2 & 3 Source 1
LW Contact (Name and Phone Number) Suman Sharma (925) 288-2332	
Name of Sampler: Suman Sharma / Rick Driscoll	

COOLER TEMPERATURE:

3.4, 4.2°

COC #: 1004

Lab: APCL

Purchase Order No:

Cooler: 2 of 2

Courier Company:

UPS

Ship Date: 4/23/03

Courier No:

1266 VS45-0144198371

Sample ID	Sample Date mm/dd/yy	Sample Time	Aqueous Preservative	ice, HNO3	ice, NaOH/Zn Acetate	MATRIX	Check if MS/MSD (requires double volume)	COMMENTS
			Aqueous Container	1x0.5L PE	1x0.5L PE			
			Solid Preservative	ice	ice			
			Solid Container	8 oz jar	8 oz jar			
Temperature Blank	—	—				A		One 40 mL in each cooler
BS01 SP 26	4/22/03	1211		✓	✓	S	ms/msd	Grid location 145
BS01 SS 27		1213						144
BS01 SS 28		1215						38
BS01 SS 29		1218						68
BS01 SS 30		1220						69
BS01 SS 31		1222						99
BS01 SS 32		1224						103
BS01 SS 33		1225						105
BS01 SS 34		1230						50
BS01 SS 35		1235						78
BS01 SS 36	✓	1240		✓	✓	✓		86

Relinquished by: (Signature)	Date / Time 4/23/03 1430	Received by: (Signature)	Relinquished by: (Signature)	Date / Time 4/24/03 0930	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)

ATTACHMENT 3

DATA QUALITY ASSESSMENT REPORT

Data Quality Assessment Report

This data quality assessment report has been prepared for soil samples collected at Hunters Point Project site under EMAC program. A total of ninety one soil, nine field duplicates, one source blank and three equipment rinsate samples were submitted for analyses to off-site laboratory. Analyses were performed by APCL located in Chino, California.

1.0 ANALYTICAL METHODS

The samples were analyzed for total metals USEPA Methods 6010B and 7470A/7471A and soluble acid sulfides by USEPA Method 9030B.

1.1 TEMPERATURE AND HOLDING TIMES

All of the samples were received by the laboratory in the acceptable temperature range of $4 \pm 2^\circ \text{C}$, and analyzed within method-specified holding times.

1.2 FIELD QC SAMPLES

The field QC samples included one source blank, three equipment rinsate blanks, and nine field duplicate samples.

1.2.1 Source Blank

Field blanks were prepared from the deionized water used in the first two rinses and final rinse of decontamination. Source blank was collected to ensure that water used during decontamination of sampling equipment was free of the parameters of interest.

Source blank sample RBS01SB001, Alhambra CMUC032117:45, had trace level detections for some metals, which were considered not detected due to method blank contamination.

The project analytical data are not qualified due to field blank sample contamination.

1.2.2 Equipment Rinsate Blanks

Equipment rinsates were collected to verify the effectiveness of sampling equipment decontamination and to monitor for potential cross contamination between samples. Equipment rinsates were collected from the final analyte-free water rinses of the equipment cleaning process. Three rinsates; RBS01EB01, RBS03EB1-334 and RBS02EB1-240, were analyzed for the project analytes. Equipment rinsates were identified in the same manner as non-QC samples.

Equipment rinsate samples were found to have some metals at trace levels, which were considered not detected due to method blank contamination. However, due to trace levels of mercury detected in two equipment blank samples. The following sample results were qualified as not-detected (U):

- Malta Drive and O' Shaughnessy Blvd. Site - 5 mercury results by USEPA Method 7471A; and
- Twin Peaks Site - 1 mercury result by USEPA Method 7471A.

Above qualifications were minor and did not affect data usability.

1.2.3 Field Duplicates

Field duplicates were collected to evaluate sampling and analytical precision and to assess sample homogeneity. Collection procedures for the field duplicate sample and the primary sample were identical, and both were analyzed for the same suite of parameters.

All of the RPD were below the 50 percent acceptance criteria, with the exceptions noted below:

- RPD between lead results of primary sample RBS01SP03 and its field duplicate was 60%; and
- RPD between lead results of primary sample RBS03CH002 and its field duplicate was 53%.

High RPD values between primary sample and field duplicate analytical data could be attributed to matrix interferences or due to the nature of replacement of the metals within the Franciscan melange. Analytical data are generally not qualified due to high RPD values.

2.0 LABORATORY QC DATA

The laboratory QC data included the following:

- Reporting limits;
- Laboratory method blank;
- Laboratory control sample and laboratory control sample duplicate (LCS/LCSD);
- Matrix spike samples (MS/MSD);
- Initial calibration check; and
- Continuing calibration check.

2.1 METHOD BLANK

For inorganic analytes, initial and continuing calibration blanks were analyzed in addition to the method blanks. When target analytes were detected in the method blanks and calibration blanks, the corresponding sample results that are less than five times the amount found in the blank are qualified as not detected. The following sample results were qualified as not-detected (U) due to method and calibration blanks contamination:

- Innes Avenue Site - 29 metal results by USEPA Method 6010B and 13 mercury results by USEPA Method 7471A;
- Malta Drive and O' Shaughnessy Blvd. Site - 17 metal results by USEPA Method 6010B;
- Twin Peaks Site - 27 metal results by USEPA Method 6010B; and
- Field QC Samples - 29 metal results by USEPA Method 6010B and 2 mercury results by USEPA Method 7471A.

Data usability was not affected due to method and calibration blanks contamination.

2.2 LABORATORY CONTROL SAMPLE AND LABORATORY CONTROL SAMPLE DUPLICATE

The laboratory control sample (LCS) and laboratory control sample duplicate are aliquots of analyte-free water spiked with all target analytes and is prepared with each extraction batch for organic and inorganic analyses. The recovery of target analytes from the LCS is measurement of method performance in an interference-free sample matrix. Failure of target analyte recovery from the LCS to meet method acceptance criteria may indicate a systematic problem with the preparation and analysis of all samples in the batch. The following sample results were qualified as estimated not-detected (UJ) due to LCS/LCSD recoveries outside the acceptance criteria of 75 to 125%:

- Innes Avenue Site - 33 soluble acid sulfide results by USEPA Method 9030B;
- Malta Drive and O' Shaughnessy Blvd. Site - 33 soluble acid sulfide results by USEPA Method 9030B;
- Twin Peaks Site - 34 soluble acid sulfide results by USEPA Method 9030B; and
- Field QC Samples - 4 soluble acid sulfide results by USEPA Method 9030B.

There is no impact on the data usability due to LCS/LCSD outliers.

2.3 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE

The matrix spike (MS) and matrix spike duplicate (MSD) samples are a portion of a field sample spiked with all target analytes, and is prepared with each extraction batch for extractable organic and inorganic analytes and with each analytical batch for volatile analytes. The MS/MSD are used to evaluate any bias introduced to the method due to matrix interferences, and to measure accuracy and precision for each analytical batch. For inorganic analyses, a field sample duplicate may be prepared in lieu of a matrix spike duplicate (MSD). The following samples results were qualified as estimated (J/UJ) due to MS/MSD and RPD recoveries outside the acceptance criteria(75 to 125% for MS/MSD recoveries and 20% for RPD):

- Innes Avenue Site - 160 metal results by USEPA Method 6010B;
- Malta Drive and O' Shaughnessy Blvd. Site - 171 metal results by USEPA Method 6010B; and
- Twin Peaks Site - 97 metal results by USEPA Method 6010B.

Data usability is not affected due to MS/MSD outliers.

2.4 INITIAL AND CONTINUING CALIBRATIONS

Instrument calibration was performed for each analysis according to the USEPA Method requirements. The linear analytical range was established for each method by analysis of standards prepared at increasing concentrations that cover the expected sample concentrations. The acceptability of the initial calibration was determined by calculation of a method-specific statistical parameter, such as a percent relative standard deviation or correlation coefficient.

Following initial calibration and routinely during sample analysis, the stability of analytical systems was monitored by analysis of standards at concentrations near the mid-point of the linear range. The accuracy of sample results associated with a non-compliant continuing calibration may be less than expected, depending on the magnitude of the deviation from method acceptance criteria

All of the initial calibration and continuing calibration check standard results met the quality control criteria.

2.5 INDUCTIVELY COUPLED PLASMA SERIAL DILUTION (REASON CODE A)

The Inductively coupled plasma (ICP) serial dilutions are performed at a frequency of 10 percent of all sample analyses for metals by USEPA Methods 6010B. The serial dilution result is expected to agree with the undiluted sample result within 10 percent. The following metal results were qualified due to non-compliant serial dilutions:

- Innes Avenue Site - 166 metal results by USEPA Method 6010B;
- Malta Drive and O' Shaughnessy Blvd. Site - 171 metal results by USEPA Method 6010B;
- Twin Peaks Site - 85 metal results by USEPA Method 6010B; and
- Field QC Samples - 6 metal results by USEPA Method 6010B.

Data usability is not affected due to serial dilution outliers.

Laboratory met all of the project required detection limits.

Over all, analytical data is of good quality and usable for the purposes of this project.

ATTACHMENT 4
GPS SURVEY DATA

**Attachment 4 - 1: Summary of Survey Results
Innes Avenue - RBS01 Data Summary**

Cell Location	Sample Location	Sample Identification	Survey Date	Northing	Easting
Innes Avenue - Rock Grid					
6	RBS01SP01	RBS01SP01	04/22/03	453642	1458343
9	RBS01SP02	RBS01SP02	04/22/03	453644	1458339
25	RBS01SP03	RBS01SP03	04/22/03	453647	1458335
25	RBS01SP03	RBS01SP04 (Field Duplicate)	04/22/03	453647	1458335
148	RBS01SP05	RBS01SP05	04/22/03	453650	1458335
138	RBS01SP06	RBS01SP06	04/22/03	453647	1458339
131	RBS01SP07	RBS01SP07	04/22/03	453646	1458344
91	RBS01SP08	RBS01SP08	04/22/03	453640	1458345
42	RBS01SP09	RBS01SP09	04/22/03	453645	1458343
49	RBS01SP10	RBS01SP10	04/22/03	453646	1458339
53	RBS01SP11	RBS01SP11	04/22/03	453647	1458336
86	RBS01SP12	RBS01SP12	04/22/03	453649	1458333
86	RBS01SP12	RBS01SP13 (Field Duplicate)	04/22/03	453649	1458333
76	RBS01SP14	RBS01SP14	04/22/03	453646	1458340
63	RBS01SP15	RBS01SP15	04/22/03	453640	1458344
105	RBS01SP16	RBS01SP16	04/22/03	453646	1458341
109	RBS01SP17	RBS01SP17	04/22/03	453647	1458339
Innes Avenue - Soil Grid					
145	RBS01SP26	RBS01SP26	04/22/03	453684	1458283
4	RBS01SS21	RBS01SS21	04/22/03	453676	1458291
4	RBS01SS21	RBS01SS22 (Field Duplicate)	04/22/03	453676	1458291
8	RBS01SS23	RBS01SS23	04/22/03	453677	1458289
9	RBS01SS24	RBS01SS24	04/22/03	453676	1458289
28	RBS01SS25	RBS01SS25	04/22/03	453683	1458281
144	RBS01SS27	RBS01SS27	04/22/03	453684	1458283
38	RBS01SS28	RBS01SS28	04/22/03	453678	1458290
68	RBS01SS29	RBS01SS29	04/22/03	453678	1458290
69	RBS01SS30	RBS01SS30	04/22/03	453678	1458290
99	RBS01SS31	RBS01SS31	04/22/03	453679	1458290
103	RBS01SS32	RBS01SS32	04/22/03	453677	1458288
105	RBS01SS33	RBS01SS33	04/22/03	453678	1458288
50	RBS01SS34	RBS01SS34	04/22/03	453681	1458285
78	RBS01SS35	RBS01SS35	04/22/03	453679	1458286
86	RBS01SS36	RBS01SS36	04/22/03	453683	1458282

SP - serpentinite

SS - soil sample

RBS01SP26 sample location was classified in the soil grid even though rock was present.

**Attachment 4 - 2: Summary of Survey Results
Twin Peaks - RBS02 Data Summary**

Cell Location	Sample Location	Sample Identification	Survey Date	Northing	Easting
Twin Peaks - Rock Grid					
112	RBS02CH112	RBS02CH112-213	06/10/03	462149	1437225
118	RBS02CH118	RBS02CH118-215	06/10/03	462149	1437228
12	RBS02CH12	RBS02CH12-205	06/10/03	462157	1437227
128	RBS02CH128	RBS02CH128-204	06/10/03	462154	1437224
145	RBS02CH145	RBS02CH145-214	06/10/03	462148	1437226
16	RBS02CH16	RBS02CH16-207	06/10/03	462152	1437227
22	RBS02CH22	RBS02CH22-210	06/10/03	462152	1437227
22	RBS02CH22	RBS02CH150-211 (Field Duplicate)	06/10/03	462152	1437227
42	RBS02CH42	RBS02CH42-206	06/10/03	462154	1437225
46	RBS02CH46	RBS02CH46-208	06/10/03	462154	1437227
53	RBS02CH53	RBS02CH53-212	06/10/03	462152	1437228
60	RBS02CH60	RBS02CH60-216	06/10/03	462149	1437230
66	RBS02CH66	RBS02CH66-202	06/10/03	462157	1437225
66	RBS02CH66	RBS02CH100-203 (Field Duplicate)	06/10/03	462157	1437225
79	RBS02CH79	RBS02CH79-209	06/10/03	462152	1437227
92	RBS02CH92	RBS02CH92-200	06/10/03	462157	1437224
95	RBS02CH95	RBS02CH95-201	06/10/03	462157	1437225
Twin Peaks - Soil Grid					
05	RBS02SS05	RBS02SS05-217	06/10/03	462219	1437270
05	RBS02SS05	RBS02SS100-218 (Field Duplicate)	06/10/03	462219	1437270
10	RBS02SS10	RBS02SS10-222	06/10/03	462222	1437267
118	RBS02SS118	RBS02SS118-231	06/10/03	462240	1437260
120	RBS02SS120	RBS02SS120-232	06/10/03	462242	1437258
129	RBS02SS129	RBS02SS129-221	06/10/03	462224	1437271
143	RBS02SS143	RBS02SS143-226	06/10/03	462236	1437264
150	RBS02SS150	RBS02SS150-233	06/10/03	462244	1437259
26	RBS02SS26	RBS02SS26-227	06/10/03	462235	1437259
35	RBS02SS35	RBS02SS35-219	06/10/03	462219	1437272
41	RBS02SS41	RBS02SS41-223	06/10/03	462225	1437267
41	RBS02SS41	RBS02SS150-224 (Field Duplicate)	06/10/03	462225	1437267
56	RBS02SS56	RBS02SS56-228	06/10/03	462236	1437260
58	RBS02SS58	RBS02SS58-229	06/10/03	462237	1437258
65	RBS02SS65	RBS02SS65-220	06/10/03	462220	1437272
75	RBS02SS75	RBS02SS75-225	06/10/03	462229	1437266
88	RBS02SS88	RBS02SS88-230	06/10/03	462239	1437260

CH - chert
SS - soil sample

Attachment 4 - 3: Summary of Survey Results
Malta Drive and O'Shaughnessy Blvd Site - RBS03 Data Summary

Cell Location	Sample Location	Sample Identification	Survey Date	Northing	Easting
Malta Drive and O'Shaughnessy Blvd Site - Rock Grid					
88	RBS03BA088	RBS03BA088-311	05/19/03	456132	1438248
109	RBS03BA109	RBS03BA109-304	05/19/03	456133	1438243
113	RBS03BA113	RBS03BA113-305	05/19/03	456132	1438243
114	RBS03BA114	RBS03BA114-306	05/19/03	456133	1438244
119	RBS03BA119	RBS03BA119-309	05/19/03	456131	1438245
119	RBS03BA119	RBS03BA119-310 (Field Duplicate)	05/19/03	456131	1438245
136	RBS03BA136	RBS03BA136-313	05/19/03	456132	1438250
143	RBS03BA143	RBS03BA143-316	05/19/03	456132	1438254
2	RBS03CH002	RBS03CH002-300	05/19/03	456132	1438244
2	RBS03CH002	RBS03CH002-301 (Field Duplicate)	05/19/03	456132	1438244
39	RBS03CH039	RBS03CH039-302	05/19/03	456132	1438246
42	RBS03CH042	RBS03CH042-307	05/19/03	456133	1438247
44	RBS03CH044	RBS03CH044-308	05/19/03	456133	1438245
67	RBS03CH067	RBS03CH067-314	05/19/03	456136	1438254
71	RBS03CH071	RBS03CH071-315	05/19/03	456132	1438253
74	RBS03CH074	RBS03CH074-303	05/19/03	456135	1438244
90	RBS03CH090	RBS03CH090-312	05/19/03	456134	1438249
96 & 132 ¹	RBS03CH96-132	RBS03DS001-317	06/19/03	456135	1438251
Malta Drive and O'Shaughnessy Blvd Site - Soil Grid					
2	RBS03SS002	RBS03SS002-318	05/19/03	456119	1438288
10	RBS03SS010	RBS03SS010-324	05/19/03	456121	1438292
22	RBS03SS022	RBS03SS022-329	05/19/03	456122	1438299
38	RBS03SS038	RBS03SS038-322	05/19/03	456119	1438292
39	RBS03SS039	RBS03SS039-323	05/19/03	456120	1438292
43	RBS03SS043	RBS03SS043-326	05/19/03	456122	1438294
52	RBS03SS052	RBS03SS052-330	05/19/03	456122	1438299
60	RBS03SS060	RBS03SS060-332	05/19/03	456122	1438303
62	RBS03SS062	RBS03SS062-319	05/19/03	456119	1438290
63	RBS03SS063	RBS03SS063-320	05/19/03	456118	1438289
72	RBS03SS072	RBS03SS072-325	05/19/03	456126	1438288
74	RBS03SS074	RBS03SS074-327	05/19/03	456122	1438294
94	RBS03SS094	RBS03SS094-321	05/19/03	456118	1438289
134	RBS03SS134	RBS03SS134-328	05/19/03	456118	1438294
148	RBS03SS148	RBS03SS148-331	05/19/03	456120	1438302

1. The discrete sample RBS03DS001-317 was collected between cells 96 and 132.

BA - basalt

CH - Chert

SS - soil sample

ATTACHMENT 5

REFERENCES

Reference

Tetra Tech EM, Inc., 2003, *Draft Field Sampling Plan and Quality Assurance Project Plan for Regional Bedrock Sites, Ambient Metals Evaluation*, Hunters Point Shipyard, San Francisco, California, April 10.

APPENDIX B
STATISTICAL RESULTS

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1.0 INTRODUCTION

Summary statistics for trace metal concentrations in soil and bedrock were calculated for the following parameters:

1. The underlying distribution
2. Number of detected samples, total number of samples, and detection frequency
3. Minimum and maximum concentrations for censored (non-detect) data only
4. Minimum and maximum concentrations for detected data only
5. Median, 95th percentile, mean, standard deviation(s), coefficient of variation (CV), and the one-sided upper 95th percent confidence limit of the mean (UCL₉₅) for detected and censored data combined

Descriptions of the individual methods used are provided below.

2.0 DISTRIBUTION TESTS

The Shapiro-Wilk W test was conducted for all samples with at least five measurements and detection frequencies greater than or equal to 50 percent. The W test is one of the most powerful tests for determining if a set of measurements follows either a normal or lognormal distribution. The W test relies on computing a correlation between the quantiles of the standard normal distribution and the ordered values of the observed data. When the W statistic is close to 1.0 the observed data will follow an essentially straight line when displayed using a normal probability plot. The following null (H_0) and alternative (H_A) hypotheses are tested using the W test:

H_0 : the data follow a normal distribution

H_A : the data do not follow a normal distribution

Tests were conducted sequentially on data in original and natural-log transformed units. A Type I error rate (α) of 0.05 (equivalent to 5 percent) was used to interpret the significance of each test. A Type I error rate of 0.05 means that there is a 5 percent chance that the null hypothesis will be rejected when it is true (that is, the data are normally distributed), leading to the false conclusion that the underlying distribution is not normal. When the test is conducted using log-transformed data, failure to reject H_0 leads to the conclusion that the data follow a lognormal distribution (rejection of H_0 indicates that the data are not lognormally distributed).

Censored (non-detect) data were evaluated in the distribution tests using the reporting limit for each chemical. Chemicals confirmed as following a normal or lognormal distribution based on the outcome of the W test were identified as "normal" or "lognormal", respectively, in summary

tables. Chemicals not confirmed as either normal or lognormal were identified as “unknown” in summary tables and were further evaluated by examining normal and lognormal probability plots, outlier box plots, and frequency histograms. Professional judgment was used to select the distribution that most closely fit the data. Chemicals judged to best fit a normal or lognormal model were listed as “Unknown[a]” or “Unknown[b]”, respectively, in summary tables.

3.0 POPULATION MOMENTS

Calculation of the mean, s , and UCL_{95} was conducted for samples with at least one detected measurement using distribution-dependent formulae. Only the minimum and maximum reporting limits were provided for chemicals with zero detections.

For samples with at least 85 percent detected data, one-half the reporting limit was substituted for censored data. For samples confirmed or assumed to follow a normal distribution, the arithmetic mean and s were calculated and the UCL_{95} was calculated using Student's t statistic. For samples confirmed or assumed to follow a lognormal distribution, minimum variance unbiased estimates (MVUE) of the mean and variance of the mean were calculated following Gilbert (1987) and U.S. Environmental Protection Agency (EPA) (2002). The UCL_{95} for samples following a lognormal distribution was calculated using Land's method.

For samples with greater than 15 percent censored data, population moments were calculated using stochastic modeling, following the “bounding” approach described in EPA (2002). This approach treats each censored datum as a random variable that can assume any value between zero and its respective reporting limit. The mean and s for samples with greater than 15 percent censored data were determined by taking the median values for the mean and standard deviation generated using either arithmetic (for confirmed or assumed normal distributions and distributions listed as “Not Tested”) or MVUE estimators (for confirmed or assumed lognormal distributions). A Monte Carlo model was used to calculate a minimum of 2,000 estimates for the mean, s , and UCL_{95} , each time substituting random values for each censored measurement. Each UCL_{95} was calculated using equations based on either the t statistic (for confirmed or assumed normal distributions), the MVUE Chebyshev method (for confirmed or assumed lognormal distributions), or the non-parametric Chebyshev method (for distributions listed as “Not Tested”). If the range (difference between the minimum and maximum) for the distribution of estimates of the UCL_{95} is small, then this indicated that censored measurements contributed little to the uncertainty of the estimate. In practice, this is generally not the case, and it is necessary to select a concentration to be used as a “plausible upper bound” for the UCL_{95} . For this investigation, the 95th percentile of the distribution was used as the upper bound concentration. The maximum concentration was not used because it represents the highest concentration that could theoretically be calculated (or nearly so based on 2,000 calculations) from the sample data and, therefore, represents a “worst case” concentration rather than a plausible upper bound.

The median (50th percentile) and 95th percentiles were also calculated for all chemicals detected in at least one sample, irrespective of the detection frequency, using nonparametric assumptions (that is, based strictly on a rank ordering of the combined detected and censored measurements). The reporting limit was substituted for censored data in calculations of the median and 95th percentile concentrations.

4.0 REFERENCES

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc. New York, New York.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to Risk Assessment Guidance for Superfund: Calculating the Concentration Term." Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." Office of Solid Waste and Emergency Response 9285.6-10. Office of Emergency and Remedial Response. Washington, DC. December.

TABLES

TABLE B-1: SUMMARY STATISTICS FOR ALL SITES AND MATRICES COMBINED

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a	SUMMARY STATISTICS											
			Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data				
			Detected	Total		Min	Max	Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c	CV
Aluminum	Unknown[b]	100	100	100	N/A	N/A	6.89E+02	3.56E+04	7.89E+03	2.57E+04	1.21E+04	1.61E+03	13	1.56E+04
Antimony	Not Tested	0	100	0	3.10E-01	4.60E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Unknown[b]	96	100	96	4.60E-01	1.00E+01	6.90E-01	3.79E+01	5.25E+00	3.13E+01	9.11E+00	1.32E+00	15	1.20E+01
Barium	Unknown[b]	100	100	100	N/A	N/A	9.40E-01	4.39E+03	3.81E+02	1.86E+03	1.40E+03	6.82E+02	49	3.21E+03
Beryllium	Not Tested	2	100	2	1.30E-01	2.30E+00	1.50E-01	3.80E-01	5.40E-01	2.20E+00	5.17E-01	5.22E-01	101	8.30E-01
Cadmium	Not Tested	16	100	16	1.60E-02	2.30E+00	1.80E-01	7.40E-01	5.00E-01	2.20E+00	2.83E-01	3.32E-01	117	4.88E-01
Calcium	Unknown[b]	99	100	99	1.00E+02	1.00E+02	4.32E+01	4.24E+03	1.08E+03	3.61E+03	1.51E+03	2.17E+02	14	1.99E+03
Chromium	Unknown[b]	100	100	100	N/A	N/A	2.70E+00	7.52E+02	5.15E+01	6.78E+02	2.08E+02	5.24E+01	25	3.30E+02
Cobalt	Unknown[b]	100	100	100	N/A	N/A	1.90E+00	1.31E+02	2.91E+01	1.16E+02	4.74E+01	5.28E+00	11	5.86E+01
Copper	Unknown[b]	97	100	97	2.10E+00	3.10E+00	3.80E+00	3.38E+02	5.00E+01	2.55E+02	1.22E+02	2.37E+01	19	1.76E+02
Iron	Unknown[b]	100	100	100	N/A	N/A	4.34E+03	2.03E+05	5.00E+04	1.02E+05	5.76E+04	3.18E+03	6	6.36E+04
Lead	Unknown[a]	99	100	99	1.00E+00	1.00E+00	1.90E-01	1.25E+02	3.33E+01	9.49E+01	3.77E+01	2.75E+01	73	4.23E+01
Magnesium	Unknown[b]	100	100	100	N/A	N/A	3.85E+02	2.10E+05	2.65E+03	1.96E+05	8.01E+04	3.98E+04	50	1.87E+05
Manganese	Unknown[b]	100	100	100	N/A	N/A	3.66E+02	4.05E+04	2.01E+03	1.99E+04	6.22E+03	1.18E+03	19	8.91E+03
Mercury	Unknown[b]	80	100	80	1.10E-02	1.00E-01	2.50E-02	6.00E-01	9.25E-02	3.20E-01	1.49E-01	2.53E-02	17	3.64E-01
Molybdenum	Not Tested	8	100	8	1.60E-01	2.30E+01	3.40E-01	1.40E+00	5.10E+00	2.20E+01	4.10E+00	4.62E+00	113	6.87E+00
Nickel	Unknown[b]	100	100	100	N/A	N/A	1.02E+01	2.12E+03	7.34E+01	1.82E+03	6.74E+02	2.25E+02	33	1.21E+03
Potassium	Unknown[b]	96	100	96	2.75E-02	3.32E+02	6.41E+01	3.34E+03	7.72E+02	3.06E+03	1.19E+03	1.83E+02	15	1.60E+03
Selenium	Lognormal	65	100	65	1.80E-01	5.00E+00	9.00E-01	2.33E+01	2.15E+00	1.19E+01	4.49E+00	1.04E+00	23	1.29E+01
Silver	Not Tested	42	100	42	5.20E-02	2.30E+01	2.40E-01	2.60E+00	1.05E+00	2.20E+01	2.80E+00	4.82E+00	172	5.67E+00
Sodium	Not Tested	2	100	2	6.41E+01	1.00E+04	8.57E+01	1.06E+02	3.65E+03	5.50E+03	1.72E+03	1.60E+03	93	2.68E+03
Thallium	Not Tested	35	100	35	2.10E-01	4.60E+01	7.20E-01	3.00E+00	1.00E+01	4.50E+01	7.63E+00	1.00E+01	131	1.36E+01
Vanadium	Lognormal	100	100	100	N/A	N/A	4.00E+00	3.56E+02	4.26E+01	2.53E+02	7.66E+01	9.63E+00	13	9.75E+01
Zinc	Lognormal	100	100	100	N/A	N/A	9.00E+00	2.67E+02	5.72E+01	1.69E+02	7.62E+01	5.62E+00	7	8.72E+01

Notes:

Concentration units are mg/kg

For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.

For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).

Details of the approach used for performing all calculations are contained in the methods section of this report.

For samples with zero detections, only the minimum and maximum reporting limit are reported.

a

For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05)

Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."

For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.

Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively

b

For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data)

c

For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae.

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators following

equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987)

Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding"

approach described in EPA (2002)

These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed

or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."

d

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).

Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach

described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed

or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested."

CV

Coefficient of variation ($[(SD/mean)^2]^{1/2}$)

Min

Minimum concentration reported

Max

Maximum concentration reported

MVUE

Minimum variance unbiased estimate

N/A

Not applicable

Q95

95th percentile (quantile)

SD

Standard deviation

UCL₉₅

The one-sided 95 percent upper confidence limit of the mean

Unknown[a]

Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.

Unknown[b]

Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term." Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

TABLE B-2: SUMMARY STATISTICS FOR INNES AVENUE, ALL MATRICES COMBINED
Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
											Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d
Detected	Total	Min	Max	Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d					
Aluminum	Unknown[b]	33	33	100	N/A	N/A	6.89E+02	9.18E+03	1.80E+03	8.70E+03	3.21E+03	5.17E+02	16	4.50E+03		
Antimony	Not Tested	0	33	0	4.60E-01	1.40E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Lognormal	31	33	94	4.60E-01	5.90E-01	6.90E-01	3.70E+00	1.40E+00	3.42E+00	1.73E+00	2.17E-01	13	2.23E+00		
Barium	Unknown[b]	33	33	100	N/A	N/A	9.40E-01	6.36E+01	7.60E+00	6.36E+01	2.28E+01	6.55E+00	29	4.58E+01		
Beryllium	Not Tested	0	33	0	5.00E-01	7.20E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Cadmium	Not Tested	0	33	0	5.00E-01	7.20E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Calcium	Unknown[b]	32	33	97	1.00E+02	1.00E+02	4.32E+01	4.24E+03	4.19E+02	3.93E+03	1.29E+03	4.55E+02	35	3.19E+03		
Chromium	Normal	33	33	100	N/A	N/A	7.29E+01	7.52E+02	5.33E+02	7.46E+02	4.92E+02	1.85E+02	38	5.47E+02		
Cobalt	Normal	33	33	100	N/A	N/A	3.43E+01	1.31E+02	8.67E+01	1.25E+02	9.15E+01	1.88E+01	21	9.70E+01		
Copper	Lognormal	30	33	91	2.10E+00	3.10E+00	3.80E+00	3.70E+01	1.11E+01	3.69E+01	1.59E+01	3.07E+00	19	2.43E+01		
Iron	Normal	33	33	100	N/A	N/A	2.26E+04	7.11E+04	4.56E+04	6.86E+04	4.87E+04	1.11E+04	23	5.19E+04		
Lead	Unknown[b]	32	33	97	1.00E+00	1.00E+00	1.90E-01	1.25E+02	1.61E+01	1.18E+02	6.14E+01	2.67E+01	43	1.99E+02		
Magnesium	Unknown[a]	33	33	100	N/A	N/A	9.52E+04	2.10E+05	1.72E+05	2.04E+05	1.62E+05	3.18E+04	20	1.71E+05		
Manganese	Unknown[b]	33	33	100	N/A	N/A	5.06E+02	3.13E+03	6.86E+02	1.84E+03	8.59E+02	5.80E+01	7	9.73E+02		
Mercury	Unknown[b]	19	33	58	1.10E-02	3.30E-02	6.90E-02	6.00E-01	8.70E-02	5.02E-01	2.05E-01	9.27E-02	45	1.09E+00		
Molybdenum	Not Tested	0	33	0	5.00E+00	7.20E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Nickel	Unknown[a]	33	33	100	N/A	N/A	4.99E+02	2.12E+03	1.62E+03	1.97E+03	1.60E+03	2.73E+02	17	1.68E+03		
Potassium	Unknown[b]	29	33	88	2.75E+02	3.32E+02	6.41E+01	8.99E+02	1.55E+02	8.79E+02	2.93E+02	5.40E+01	18	4.37E+02		
Selenium	Not Tested	12	33	36	1.80E-01	5.00E+00	1.90E+00	3.30E+00	1.40E+00	3.81E+00	1.19E+00	1.10E+00	92	2.20E+00		
Silver	Not Tested	0	33	0	5.20E-02	5.00E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Sodium	Not Tested	2	33	6	5.90E+02	5.00E+03	8.57E+01	1.06E+02	5.00E+03	5.00E+03	1.43E+03	1.54E+03	107	3.05E+03		
Thallium	Unknown[b]	25	33	76	2.10E-01	1.40E+01	7.50E-01	3.00E+00	2.50E+00	1.33E+01	3.21E+00	8.07E-01	25	1.20E+01		
Vanadium	Unknown[b]	33	33	100	N/A	N/A	4.00E+00	4.36E+01	1.56E+01	4.14E+01	2.10E+01	2.61E+00	12	2.69E+01		
Zinc	Unknown[b]	33	33	100	N/A	N/A	2.02E+01	1.24E+02	3.73E+01	1.23E+02	5.40E+01	6.35E+00	12	6.82E+01		

Notes. Concentration units are mg/kg
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).
Details of the approach used for performing all calculations are contained in the methods section of this report.
For samples with zero detections, only the minimum and maximum reporting limit are reported.

- a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).
Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."
For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.
Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.
- b For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).
- c For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae.
For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002).
These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."
- d For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested."

CV	Coefficient of variation ((SD/mean)*100)	Q95	95th percentile (quantile)
Min	Minimum concentration reported	SD	Standard deviation
Max	Maximum concentration reported	UCL ₉₅	The one-sided 95 percent upper confidence limit of the mean
MVUE	Minimum variance unbiased estimate	Unknown[a]	Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms
N/A	Not applicable	Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms

Sources:
Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc. New York, NY.
U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term." Interim Report, Volume 1, Number 1, Publication 92/5-7-081.
EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10, Washington, D.C. December 2002.

TABLE B-3: SUMMARY STATISTICS FOR INNES AVENUE, ROCK MATRIX

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

		SUMMARY STATISTICS												
		Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
									Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d
Chemical	Distribution ^a	Detected	Total		Min	Max	Min	Max						
Aluminum	Normal	18	18	100	N/A	N/A	6.89E+02	2.10E+03	1.27E+03	2.10E+03	1.24E+03	3.91E+02	31	1.40E+03
Antimony	Not Tested	0	18	0	4.60E-01	1.00E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Normal	16	18	89	4.60E-01	5.90E-01	6.90E-01	1.50E+00	9.65E-01	1.50E+00	9.41E-01	3.37E-01	36	1.08E+00
Barium	Lognormal	18	18	100	N/A	N/A	9.40E-01	1.14E+01	3.80E+00	1.14E+01	4.42E+00	7.81E-01	18	6.59E+00
Beryllium	Not Tested	0	18	0	5.00E-01	5.00E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	Not Tested	0	18	0	5.00E-01	5.00E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calcium	Lognormal	17	18	94	1.00E+02	1.00E+02	4.32E+01	9.84E+02	1.27E+02	9.84E+02	1.69E+02	3.43E+01	20	2.73E+02
Chromium	Normal	18	18	100	N/A	N/A	7.29E+01	6.45E+02	3.78E+02	6.45E+02	3.87E+02	1.76E+02	45	4.60E+02
Cobalt	Unknown[a]	18	18	100	N/A	N/A	3.43E+01	9.74E+01	8.22E+01	9.74E+01	7.91E+01	1.30E+01	16	8.44E+01
Copper	Lognormal	15	18	83	2.10E+00	3.10E+00	3.80E+00	1.66E+01	5.70E+00	1.66E+01	7.17E+00	1.62E+00	23	2.71E+01
Iron	Unknown[a]	18	18	100	N/A	N/A	2.26E+04	4.81E+04	4.14E+04	4.81E+04	4.09E+04	5.71E+03	14	4.32E+04
Lead	Lognormal	17	18	94	1.00E+00	1.00E+00	1.90E-01	3.61E+01	6.65E+00	3.61E+01	1.35E+01	5.95E+00	44	5.89E+01
Magnesium	Normal	18	18	100	N/A	N/A	1.53E+05	2.10E+05	1.85E+05	2.10E+05	1.84E+05	1.40E+04	8	1.90E+05
Manganese	Lognormal	18	18	100	N/A	N/A	5.06E+02	8.26E+02	6.16E+02	8.26E+02	6.15E+02	1.79E+01	3	6.49E+02
Mercury	Not Tested	4	18	22	1.10E-02	3.30E-02	6.90E-02	1.50E-01	1.95E-02	1.50E-01	3.23E-02	4.66E-02	144	8.12E-02
Molybdenum	Not Tested	0	18	0	5.00E+00	5.00E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	Unknown[a]	18	18	100	N/A	N/A	4.99E+02	1.91E+03	1.57E+03	1.91E+03	1.50E+03	3.09E+02	21	1.63E+03
Potassium	Lognormal	18	18	100	N/A	N/A	6.41E+01	1.74E+02	9.66E+01	1.74E+02	1.01E+02	6.90E+00	7	1.15E+02
Selenium	Not Tested	0	18	0	1.80E-01	5.00E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Silver	Not Tested	0	18	0	5.20E-02	5.00E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sodium	Not Tested	1	18	6	5.00E+03	5.00E+03	1.06E+02	1.06E+02	5.00E+03	5.00E+03	2.39E+03	1.51E+03	63	4.52E+03
Thallium	Normal	18	18	100	N/A	N/A	1.60E+00	3.00E+00	2.65E+00	3.00E+00	2.56E+00	3.60E-01	14	2.71E+00
Vanadium	Normal	18	18	100	N/A	N/A	4.00E+00	1.56E+01	1.22E+01	1.56E+01	1.10E+01	3.96E+00	36	1.26E+01
Zinc	Unknown[b]	18	18	100	N/A	N/A	2.02E+01	5.17E+01	2.60E+01	5.17E+01	2.88E+01	1.93E+00	7	3.27E+01

Notes

Concentration units are mg/kg

For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.

For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).

Details of the approach used for performing all calculations are contained in the methods section of this report.

For samples with zero detections, only the minimum and maximum reporting limit are reported.

a

For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).

Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."

For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.

Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b

For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).

c

For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae.

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).

Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002).

These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."

d

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).

Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested".

CV

Coefficient of variation ((SD/mean)*100)

Q95

95th percentile (quantile)

Min

Minimum concentration reported

SD

Standard deviation

Max

Maximum concentration reported

UCL₉₅

The one-sided 95 percent upper confidence limit of the mean

MVUE

Minimum variance unbiased estimate

Unknown[a]

Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.

N/A

Not applicable

Unknown[b]

Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

TABLE B-4: SUMMARY STATISTICS FOR INNES AVENUE, SOIL MATRIX
Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a	SUMMARY STATISTICS												
			Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
										Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c
Detected	Total	Min	Max	Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d				
Aluminum	Normal	15	15	100	N/A	N/A	2.77E+03	9.18E+03	5.68E+03	9.18E+03	5.58E+03	2.21E+03	40	6.58E+03	
Antimony	Not Tested	0	15	0	1.20E+01	1.40E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Arsenic	Normal	15	15	100	N/A	N/A	1.50E+00	3.70E+00	2.60E+00	3.70E+00	2.57E+00	5.90E-01	23	2.84E+00	
Barium	Normal	15	15	100	N/A	N/A	1.34E+01	6.36E+01	3.70E+01	6.36E+01	3.94E+01	1.79E+01	45	4.75E+01	
Beryllium	Not Tested	0	15	0	5.90E-01	7.20E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Cadmium	Not Tested	0	15	0	5.90E-01	7.20E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Calcium	Lognormal	15	15	100	N/A	N/A	6.06E+02	4.24E+03	1.82E+03	4.24E+03	2.21E+03	3.74E+02	17	3.25E+03	
Chromium	Normal	15	15	100	N/A	N/A	4.20E+02	7.52E+02	6.42E+02	7.52E+02	6.18E+02	9.71E+01	16	6.62E+02	
Cobalt	Lognormal	15	15	100	N/A	N/A	8.33E+01	1.31E+02	1.06E+02	1.31E+02	1.06E+02	3.42E+00	3	1.13E+02	
Copper	Normal	15	15	100	N/A	N/A	9.40E+00	3.70E+01	2.47E+01	3.70E+01	2.44E+01	9.14E+00	37	2.86E+01	
Iron	Normal	15	15	100	N/A	N/A	4.24E+04	7.11E+04	5.88E+04	7.11E+04	5.80E+04	8.36E+03	14	6.18E+04	
Lead	Normal	15	15	100	N/A	N/A	1.38E+01	1.25E+02	6.98E+01	1.25E+02	6.83E+01	3.77E+01	55	8.54E+01	
Magnesium	Normal	15	15	100	N/A	N/A	9.52E+04	1.74E+05	1.33E+05	1.74E+05	1.34E+05	2.52E+04	19	1.46E+05	
Manganese	Unknown[b]	15	15	100	N/A	N/A	8.12E+02	3.13E+03	1.05E+03	3.13E+03	1.16E+03	9.60E+01	8	1.37E+03	
Mercury	Lognormal	15	15	100	N/A	N/A	8.60E-02	6.00E-01	2.30E-01	6.00E-01	2.43E-01	4.17E-02	17	3.61E-01	
Molybdenum	Not Tested	0	15	0	5.90E+00	7.20E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Nickel	Lognormal	15	15	100	N/A	N/A	1.46E+03	2.12E+03	1.69E+03	2.12E+03	1.72E+03	4.25E+01	2		
Potassium	Normal	11	15	73	2.75E+02	3.32E+02	4.50E+02	8.99E+02	5.66E+02	8.99E+02	5.40E+02	2.81E+02	52	6.74E+02	
Selenium	Normal	12	15	80	8.50E-01	1.40E+00	1.90E+00	3.30E+00	2.20E+00	3.30E+00	2.06E+00	9.14E-01	44	2.50E+00	
Silver	Not Tested	0	15	0	8.60E-02	2.60E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Sodium	Not Tested	1	15	7	5.90E+02	7.20E+02	8.57E+01	8.57E+01	6.50E+02	7.20E+02	3.09E+02	1.90E+02	62	6.14E+02	
Thallium	Not Tested	7	15	47	2.10E-01	1.40E+01	7.50E-01	1.80E+00	1.20E+00	1.40E+01	2.40E+00	3.32E+00	138	8.25E+00	
Vanadium	Lognormal	15	15	100	N/A	N/A	2.52E+01	4.36E+01	3.08E+01	4.36E+01	3.19E+01	1.37E+00	4	3.46E+01	
Zinc	Normal	15	15	100	N/A	N/A	3.73E+01	1.24E+02	8.74E+01	1.24E+02	8.49E+01	3.18E+01	37	9.94E+01	

Notes. Concentration units are mg/kg
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).
Details of the approach used for performing all calculations are contained in the methods section of this report.
For samples with zero detections, only the minimum and maximum reporting limit are reported.

- a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).
Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested".
For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.
Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.
- b For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).
- c For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae.
For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002).
These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."
- d For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested".

CV	Coefficient of variation [(SD/mean)*100]	Q95	95th percentile (quantile)
Min	Minimum concentration reported	SD	Standard deviation
Max	Maximum concentration reported	UCL ₉₅	The one-sided 95 percent upper confidence limit of the mean
MVUE	Minimum variance unbiased estimate	Unknown[a]	Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.
N/A	Not applicable	Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:
Gilbert R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.
U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1, Publication 9285.7-081.
EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

TABLE B-5: SUMMARY STATISTICS FOR TWIN PEAKS, ALL MATRICES COMBINED
Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
											Detected	Total	Min	Max	Min	Max
Aluminum	Unknown[b]	34	34	100	N/A	N/A	2.01E+03	2.14E+04	1.26E+04	2.11E+04	1.28E+04	1.65E+03	13	1.66E+04		
Antimony	Not Tested	0	34	0	6.20E-01	4.60E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Unknown[b]	34	34	100	N/A	N/A	2.20E+00	3.79E+01	7.45E+00	3.48E+01	1.24E+01	1.80E+00	14	1.67E+01		
Barium	Lognormal	34	34	100	N/A	N/A	2.05E+02	4.39E+03	5.97E+02	3.07E+03	9.45E+02	1.52E+02	16	1.33E+03		
Beryllium	Not Tested	2	34	6	2.00E+00	2.30E+00	1.50E-01	3.80E-01	2.05E+00	2.30E+00	1.01E+00	6.26E-01	62	1.65E+00		
Cadmium	Not Tested	12	34	35	3.90E-02	2.30E+00	1.80E-01	7.40E-01	2.15E-01	2.30E+00	3.81E-01	5.07E-01	133	9.29E-01		
Calcium	Unknown[b]	34	34	100	N/A	N/A	2.79E+02	2.00E+03	1.03E+03	1.92E+03	1.14E+03	1.41E+02	12	1.46E+03		
Chromium	Unknown[b]	34	34	100	N/A	N/A	3.10E+00	5.73E+01	2.23E+01	5.72E+01	3.24E+01	5.83E+00	18	4.78E+01		
Cobalt	Lognormal	34	34	100	N/A	N/A	4.40E+00	4.27E+01	1.25E+01	3.68E+01	1.58E+01	1.37E+00	9	1.86E+01		
Copper	Unknown[b]	34	34	100	N/A	N/A	2.91E+01	3.36E+02	7.08E+01	3.34E+02	1.20E+02	1.71E+01	14	1.61E+02		
Iron	Normal	34	34	100	N/A	N/A	1.02E+04	1.07E+05	4.58E+04	8.79E+04	4.74E+04	1.95E+04	41	5.31E+04		
Lead	Normal	34	34	100	N/A	N/A	8.80E+00	7.73E+01	3.84E+01	7.32E+01	3.90E+01	1.55E+01	40	4.35E+01		
Magnesium	Unknown[a]	34	34	100	N/A	N/A	5.16E+02	2.64E+03	2.09E+03	2.59E+03	1.72E+03	7.53E+02	44	1.94E+03		
Manganese	Unknown[a]	34	34	100	N/A	N/A	3.66E+02	4.05E+04	4.32E+03	2.78E+04	8.71E+03	9.69E+03	111	1.15E+04		
Mercury	Normal	33	34	97	2.00E-02	2.00E-02	2.50E-02	1.50E-01	7.65E-02	1.35E-01	7.60E-02	3.25E-02	43	8.54E-02		
Molybdenum	Not Tested	8	34	24	1.60E-01	2.30E+01	3.40E-01	1.40E+00	2.00E+01	2.30E+01	6.86E+00	6.86E+00	100	1.38E+01		
Nickel	Unknown[b]	34	34	100	N/A	N/A	1.02E+01	1.43E+02	3.21E+01	1.33E+02	5.56E+01	8.79E+00	16	7.75E+01		
Potassium	Unknown[b]	34	34	100	N/A	N/A	1.35E+02	3.34E+03	1.98E+03	3.18E+03	1.95E+03	3.79E+02	19	3.00E+03		
Selenium	Unknown[b]	29	34	85	5.10E-01	7.90E-01	9.00E-01	2.33E+01	3.70E+00	1.70E+01	7.04E+00	2.13E+00	30	1.48E+01		
Silver	Not Tested	14	34	41	8.80E-02	2.30E+01	2.40E-01	1.60E+00	2.05E+01	2.30E+01	6.10E+00	7.10E+00	117	1.33E+01		
Sodium	Not Tested	0	34	0	6.41E+01	2.30E+03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Thallium	Not Tested	10	34	29	6.70E-01	4.60E+01	7.20E-01	2.30E+00	4.15E+01	4.60E+01	1.51E+01	1.42E+01	94	2.99E+01		
Vanadium	Unknown[b]	34	34	100	N/A	N/A	1.49E+01	8.48E+01	5.00E+01	8.41E+01	5.48E+01	5.10E+00	9	6.55E+01		
Zinc	Lognormal	34	34	100	N/A	N/A	2.49E+01	2.67E+02	6.44E+01	2.03E+02	8.85E+01	8.26E+00	9	1.06E+02		

Notes: Concentration units are mg/kg

For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.

For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).

Details of the approach used for performing all calculations are contained in the methods section of this report.

For samples with zero detections, only the minimum and maximum reporting limit are reported.

- a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05). Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested." For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms. Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.
- b For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).
- c For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulas. For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987). For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987). Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."
- d For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987). For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987). Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested."

CV	Coefficient of variation ((SD/mean)*100)	Q95	95th percentile (quantile)
Min	Minimum concentration reported	SD	Standard deviation
Max	Maximum concentration reported	UCL ₉₅	The one-sided 95 percent upper confidence limit of the mean
MVUE	Minimum variance unbiased estimate	Unknown[a]	Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.
N/A	Not applicable	Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1, Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C., December 2002.

TABLE B-6: SUMMARY STATISTICS FOR TWIN PEAKS, ROCK MATRIX
Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
											Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c
Aluminum	Lognormal	17	17	100	N/A	N/A	2.01E+03	1.50E+04	6.20E+03	1.50E+04	6.44E+03	8.02E+02	12	8.36E+03		
Antimony	Not Tested	0	17	0	6.20E-01	4.00E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Lognormal	17	17	100	N/A	N/A	7.60E+00	3.79E+01	1.88E+01	3.79E+01	2.00E+01	2.33E+00	12	2.55E+01		
Barium	Lognormal	17	17	100	N/A	N/A	6.58E+02	4.39E+03	1.23E+03	4.39E+03	1.58E+03	2.06E+02	13	2.08E+03		
Beryllium	Not Tested	2	17	12	2.00E+00	2.00E+00	1.50E-01	3.80E-01	2.00E+00	2.00E+00	9.13E-01	5.91E-01	65	1.81E+00		
Cadmium	Lognormal	12	17	71	6.50E-02	1.40E-01	1.80E-01	7.40E-01	3.30E-01	7.40E-01	3.26E-01	9.85E-02	30	1.54E+00		
Calcium	Lognormal	17	17	100	N/A	N/A	2.79E+02	1.06E+03	5.56E+02	1.06E+03	5.68E+02	5.93E+01	10	7.01E+02		
Chromium	Normal	17	17	100	N/A	N/A	3.10E+00	1.68E+01	1.03E+01	1.68E+01	9.84E+00	3.49E+00	35	1.13E+01		
Cobalt	Normal	17	17	100	N/A	N/A	4.40E+00	4.27E+01	1.95E+01	4.27E+01	2.01E+01	1.00E+01	50	2.43E+01		
Copper	Lognormal	17	17	100	N/A	N/A	8.99E+01	3.36E+02	1.94E+02	3.36E+02	1.95E+02	1.79E+01	9	2.34E+02		
Iron	Normal	17	17	100	N/A	N/A	1.02E+04	1.07E+05	5.93E+04	1.07E+05	5.20E+04	2.67E+04	51	6.33E+04		
Lead	Normal	17	17	100	N/A	N/A	8.80E+00	7.73E+01	3.68E+01	7.73E+01	3.66E+01	1.75E+01	48	4.40E+01		
Magnesium	Lognormal	17	17	100	N/A	N/A	5.16E+02	2.39E+03	1.03E+03	2.39E+03	1.12E+03	1.29E+02	12	1.42E+03		
Manganese	Lognormal	17	17	100	N/A	N/A	7.80E+03	4.05E+04	1.45E+04	4.05E+04	1.67E+04	1.64E+03	10	2.03E+04		
Mercury	Normal	17	17	100	N/A	N/A	2.50E-02	8.50E-02	5.00E-02	8.50E-02	5.48E-02	1.78E-02	33	6.24E-02		
Molybdenum	Not Tested	2	17	12	1.90E-01	2.00E+01	7.70E-01	1.40E+00	2.00E+01	2.00E+01	8.42E+00	6.38E+00	76	1.80E+01		
Nickel	Normal	17	17	100	N/A	N/A	4.30E+01	1.43E+02	8.76E+01	1.43E+02	9.10E+01	2.81E+01	31	1.03E+02		
Potassium	Lognormal	17	17	100	N/A	N/A	1.35E+02	2.29E+03	6.47E+02	2.29E+03	7.05E+02	1.35E+02	19	1.10E+03		
Selenium	Lognormal	17	17	100	N/A	N/A	5.60E+00	2.33E+01	1.03E+01	2.33E+01	1.06E+01	9.08E-01	9	1.26E+01		
Silver	Unknown[b]	14	17	82	8.80E-02	2.00E+01	2.40E-01	1.60E+00	4.40E-01	2.00E+01	8.79E-01	2.93E-01	33	3.86E+00		
Sodium	Not Tested	0	17	0	6.41E+01	2.00E+03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Thallium	Unknown[b]	10	17	59	6.70E-01	4.00E+01	7.20E-01	2.30E+00	1.50E+00	4.00E+01	7.61E+00	3.20E+00	42	4.04E+01		
Vanadium	Normal	17	17	100	N/A	N/A	1.49E+01	5.42E+01	3.15E+01	5.42E+01	3.30E+01	1.07E+01	33	3.75E+01		
Zinc	Lognormal	17	17	100	N/A	N/A	6.70E+01	2.67E+02	1.16E+02	2.67E+02	1.26E+02	1.17E+01	9	1.52E+02		

Notes. Concentration units are mg/kg
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).
Details of the approach used for performing all calculations are contained in the methods section of this report.
For samples with zero detections, only the minimum and maximum reporting limit are reported.

- a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).
Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."
For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.
Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.
- b For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data)
- c For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulas.
For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002).
These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."
- d For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested."

CV	Coefficient of variation [(SD/mean)*100]	Q95	95th percentile (quantile)
Min	Minimum concentration reported	SD	Standard deviation
Max	Maximum concentration reported	UCL ₉₅	The one-sided 95 percent upper confidence limit of the mean
MVUE	Minimum variance unbiased estimate	Unknown[a]	Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.
N/A	Not applicable	Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources.
Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.
U.S. Environmental Protection Agency (EPA), 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term." Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.
EPA, 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

TABLE B-7: SUMMARY STATISTICS FOR TWIN PEAKS, SOIL MATRIX

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical	Distribution ^a	SUMMARY STATISTICS											
		Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected & Censored Data				
		Detected	Total		Min	Max	Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c	CV
Aluminum	Unknown[a]	17	17	100	N/A	N/A	1.02E+04	2.14E+04	1.88E+04	2.14E+04	1.84E+04	2.56E+03	14
Antimony	Not Tested	0	17	0	4.30E+01	4.60E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Normal	17	17	100	N/A	N/A	2.20E+00	7.30E+00	4.90E+00	7.30E+00	4.94E+00	1.09E+00	22
Barium	Lognormal	17	17	100	N/A	N/A	2.05E+02	5.35E+02	3.30E+02	5.35E+02	3.38E+02	2.17E+01	6
Beryllium	Not Tested	0	17	0	2.10E+00	2.30E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	Not Tested	0	17	0	3.90E-02	2.30E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calcium	Unknown[a]	17	17	100	N/A	N/A	7.65E+02	2.00E+03	1.73E+03	2.00E+03	1.66E+03	2.79E+02	17
Chromium	Unknown[a]	17	17	100	N/A	N/A	2.77E+01	5.73E+01	5.29E+01	5.73E+01	5.13E+01	7.09E+00	14
Cobalt	Unknown[a]	17	17	100	N/A	N/A	6.20E+00	1.35E+01	1.19E+01	1.35E+01	1.15E+01	1.64E+00	14
Copper	Unknown[a]	17	17	100	N/A	N/A	2.91E+01	5.17E+01	4.73E+01	5.17E+01	4.60E+01	5.16E+00	11
Iron	Unknown[a]	17	17	100	N/A	N/A	2.49E+04	4.95E+04	4.37E+04	4.95E+04	4.28E+04	5.68E+03	13
Lead	Normal	17	17	100	N/A	N/A	1.64E+01	7.18E+01	3.91E+01	7.18E+01	4.13E+01	1.33E+01	32
Magnesium	Unknown[a]	17	17	100	N/A	N/A	1.32E+03	2.64E+03	2.36E+03	2.64E+03	2.32E+03	3.04E+02	13
Manganese	Unknown[a]	17	17	100	N/A	N/A	3.66E+02	8.35E+02	7.02E+02	8.35E+02	6.95E+02	1.14E+02	16
Mercury	Normal	16	17	94	2.00E-02	2.00E-02	7.40E-02	1.50E-01	1.00E-01	1.50E-01	9.71E-02	3.03E-02	31
Molybdenum	Not Tested	6	17	35	1.60E-01	2.30E+01	3.40E-01	5.40E-01	5.40E-01	2.30E+01	5.38E+00	7.04E+00	131
Nickel	Unknown[a]	17	17	100	N/A	N/A	1.02E+01	2.12E+01	1.92E+01	2.12E+01	1.86E+01	2.59E+00	14
Potassium	Unknown[a]	17	17	100	N/A	N/A	1.67E+03	3.34E+03	2.89E+03	3.34E+03	2.82E+03	3.88E+02	14
Selenium	Lognormal	12	17	71	5.10E-01	7.90E-01	9.00E-01	1.80E+00	1.10E+00	1.80E+00	1.07E+00	2.47E-01	23
Silver	Not Tested	0	17	0	2.10E+01	2.30E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sodium	Not Tested	0	17	0	2.10E+03	2.30E+03	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	Not Tested	0	17	0	4.30E+01	4.60E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	Unknown[a]	17	17	100	N/A	N/A	4.01E+01	8.48E+01	7.71E+01	8.48E+01	7.52E+01	1.04E+01	14
Zinc	Unknown[a]	17	17	100	N/A	N/A	2.49E+01	6.18E+01	5.30E+01	6.18E+01	5.20E+01	8.23E+00	16

Notes

Concentration units are mg/kg

For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.

For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).

Details of the approach used for performing all calculations are contained in the methods section of this report.

For samples with zero detections, only the minimum and maximum reporting limit are reported.

a

For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).

Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."

For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.

Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b

For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).

c

For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulas.

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following

equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).

Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002).

These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed

or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."

d

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).

Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach

described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed

or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested."

CV

Coefficient of variation [(SD/mean)*100]

Min

Minimum concentration reported

Max

Maximum concentration reported

MVUE

Minimum variance unbiased estimate

N/A

Not applicable

Q95

95th percentile (quantile)

SD

Standard deviation

UCL₉₅

The one-sided 95 percent upper confidence limit of the mean

Unknown[a]

Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.

Unknown[b]

Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 6285.6-10, Washington, D.C. December 2002.

TABLE B-8: SUMMARY STATISTICS FOR MALTA & O'SHAUGHNESSY, ALL MATRICES COMBINED

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
											Detected	Total	Min	Max	Min	Max
Aluminum	Normal	33	33	100	N/A	N/A	1.74E+03	3.56E+04	1.60E+04	3.35E+04	1.64E+04	8.83E+03	54	1.90E+04		
Antimony	Not Tested	0	33	0	3.10E-01	1.10E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Lognormal	31	33	94	1.00E+01	1.00E+01	1.30E+00	3.42E+01	8.00E+00	3.22E+01	1.11E+01	1.53E+00	14	1.47E+01		
Barium	Lognormal	33	33	100	N/A	N/A	1.39E+02	1.32E+03	5.39E+02	1.21E+03	5.61E+02	5.04E+01	9	6.66E+02		
Beryllium	Not Tested	0	33	0	1.30E-01	5.60E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Cadmium	Not Tested	4	33	12	1.60E-02	5.00E-01	2.80E-01	4.50E-01	3.80E-01	5.00E-01	1.80E-01	1.55E-01	86	3.36E-01		
Calcium	Unknown[b]	33	33	100	N/A	N/A	2.21E+02	3.79E+03	1.24E+03	3.66E+03	1.62E+03	1.85E+02	11	2.03E+03		
Chromium	Normal	33	33	100	N/A	N/A	2.70E+00	7.71E+01	3.63E+01	7.19E+01	3.56E+01	1.81E+01	51	4.09E+01		
Cobalt	Normal	33	33	100	N/A	N/A	1.90E+00	7.44E+01	2.74E+01	6.50E+01	2.88E+01	1.60E+01	56	3.35E+01		
Copper	Normal	33	33	100	N/A	N/A	3.22E+01	2.69E+02	1.53E+02	2.61E+02	1.41E+02	5.29E+01	38	1.56E+02		
Iron	Unknown[a]	33	33	100	N/A	N/A	4.34E+03	2.03E+05	7.64E+04	1.50E+05	7.36E+04	3.51E+04	48	8.40E+04		
Lead	Lognormal	33	33	100	N/A	N/A	3.30E+00	9.37E+01	3.08E+01	8.24E+01	3.95E+01	5.51E+00	14	5.25E+01		
Magnesium	Lognormal	33	33	100	N/A	N/A	3.85E+02	1.19E+04	2.65E+03	9.21E+03	3.45E+03	5.34E+02	15	4.77E+03		
Manganese	Unknown[b]	33	33	100	N/A	N/A	2.00E+03	2.21E+04	7.40E+03	1.45E+04	7.53E+03	6.34E+02	8	8.83E+03		
Mercury	Lognormal	28	33	85	7.90E-02	1.00E-01	3.10E-02	3.70E-01	1.40E-01	3.28E-01	1.49E-01	2.32E-02	16	3.60E-01		
Molybdenum	Not Tested	0	33	0	5.00E+00	5.60E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Nickel	Normal	33	33	100	N/A	N/A	1.36E+01	1.03E+02	6.18E+01	1.03E+02	5.82E+01	2.24E+01	38	6.49E+01		
Potassium	Normal	33	33	100	N/A	N/A	1.19E+02	2.02E+03	1.06E+03	1.93E+03	1.02E+03	4.61E+02	45	1.16E+03		
Selenium	Normal	24	33	73	3.50E-01	5.00E+00	1.40E+00	9.20E+00	3.20E+00	7.24E+00	2.90E+00	1.82E+00	63	3.60E+00		
Silver	Unknown[b]	28	33	85	1.20E-01	5.00E+00	5.50E-01	2.60E+00	8.80E-01	3.32E+00	1.12E+00	2.09E-01	19	3.40E+00		
Sodium	Not Tested	0	33	0	5.00E+03	1.00E+04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Thallium	Not Tested	0	33	0	1.00E+01	1.10E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Vanadium	Unknown[a]	33	33	100	N/A	N/A	9.00E+00	3.56E+02	1.34E+02	3.44E+02	1.46E+02	8.87E+01	61	1.72E+02		
Zinc	Unknown[b]	33	33	100	N/A	N/A	9.00E+00	1.69E+02	6.23E+01	1.67E+02	8.46E+01	1.20E+01	14	1.13E+02		

Notes

Concentration units are mg/kg

For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.

For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).

Details of the approach used for performing all calculations are contained in the methods section of this report.

For samples with zero detections, only the minimum and maximum reporting limit are reported.

a

For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).

Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."

For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.

Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b

For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data)

c

For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulas.

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following

equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).

Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding"

approach described in EPA (2002)

These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."

d

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992; Gilbert 1987).

Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach

described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed

or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested."

CV

Coefficient of variation ((SD/mean)*100)

Q95

95th percentile (quantile)

Min

Minimum concentration reported

SD

Standard deviation

Max

Maximum concentration reported

UCL₉₅

The one-sided 95 percent upper confidence limit of the mean

MVUE

Minimum variance unbiased estimate

Unknown[a]

Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms

N/A

Not applicable

Unknown[b]

Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term." *Intermittent Bulletin*, Volume 1, Number 1, Publication 9285.7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10, Washington, D.C., December 2002.

TABLE B-9: SUMMARY STATISTICS FOR MALTA & O'SHAUGHNESSY, ROCK MATRIX

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		SUMMARY STATISTICS												
		Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
		Detected	Total		Min	Max	Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d
Aluminum	Normal	18	18	100	N/A	N/A	4.85E+03	3.56E+04	2.17E+04	3.56E+04	2.09E+04	8.74E+03	42	2.45E+04
Antimony	Not Tested	0	18	0	3.10E-01	1.00E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Lognormal	16	18	89	1.00E+01	1.00E+01	1.30E+00	3.42E+01	9.85E+00	3.42E+01	1.40E+01	3.19E+00	23	2.45E+01
Barium	Normal	18	18	100	N/A	N/A	1.39E+02	7.47E+02	5.15E+02	7.47E+02	4.82E+02	1.74E+02	36	5.53E+02
Beryllium	Not Tested	0	18	0	5.00E-01	5.00E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	Not Tested	0	18	0	1.60E-02	5.00E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calcium	Normal	18	18	100	N/A	N/A	2.21E+02	2.04E+03	1.13E+03	2.04E+03	1.11E+03	3.99E+02	36	1.27E+03
Chromium	Normal	18	18	100	N/A	N/A	1.09E+01	7.71E+01	4.18E+01	7.71E+01	4.40E+01	1.84E+01	42	5.15E+01
Cobalt	Normal	18	18	100	N/A	N/A	9.30E+00	7.44E+01	3.54E+01	7.44E+01	3.63E+01	1.68E+01	46	4.32E+01
Copper	Normal	18	18	100	N/A	N/A	6.18E+01	2.57E+02	1.64E+02	2.57E+02	1.59E+02	4.06E+01	26	1.76E+02
Iron	Unknown[a]	18	18	100	N/A	N/A	1.91E+04	2.03E+05	8.56E+04	2.03E+05	8.74E+04	3.74E+04	43	1.03E+05
Lead	Normal	18	18	100	N/A	N/A	9.30E+00	4.91E+01	2.41E+01	4.91E+01	2.43E+01	1.05E+01	43	2.86E+01
Magnesium	Lognormal	18	18	100	N/A	N/A	3.88E+02	1.19E+04	2.51E+03	1.19E+04	3.15E+03	6.04E+02	19	4.92E+03
Manganese	Normal	18	18	100	N/A	N/A	4.12E+03	1.03E+04	7.20E+03	1.03E+04	6.97E+03	1.98E+03	28	7.79E+03
Mercury	Lognormal	18	18	100	N/A	N/A	3.10E-02	3.70E-01	1.60E-01	3.70E-01	1.55E-01	2.87E-02	18	2.37E-01
Molybdenum	Not Tested	0	18	0	5.00E+00	5.00E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	Normal	18	18	100	N/A	N/A	2.32E+01	1.03E+02	6.38E+01	1.03E+02	6.42E+01	1.95E+01	30	7.22E+01
Potassium	Normal	18	18	100	N/A	N/A	1.56E+02	1.89E+03	8.61E+02	1.89E+03	8.76E+02	4.04E+02	46	1.04E+03
Selenium	Unknown[a]	10	18	56	3.50E-01	5.00E+00	1.80E+00	5.30E+00	3.65E+00	5.30E+00	2.55E+00	1.52E+00	60	3.50E+00
Silver	Unknown[b]	16	18	89	1.50E-01	5.00E+00	5.50E-01	1.60E+00	1.00E+00	5.00E+00	1.08E+00	1.96E-01	18	1.64E+00
Sodium	Not Tested	0	18	0	5.00E+03	1.00E+04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	Not Tested	0	18	0	1.00E+01	1.00E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	Normal	18	18	100	N/A	N/A	3.63E+01	3.56E+02	1.57E+02	3.56E+02	1.89E+02	9.35E+01	50	2.27E+02
Zinc	Lognormal	18	18	100	N/A	N/A	9.00E+00	1.69E+02	4.49E+01	1.69E+02	6.77E+01	1.29E+01	19	1.05E+02

Notes: Concentration units are mg/kg
 For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.
 For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).
 Details of the approach used for performing all calculations are contained in the methods section of this report.
 For samples with zero detections, only the minimum and maximum reporting limit are reported.

^a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).
 Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."
 For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.
 Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

^b For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).
^c For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae.

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).
 For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
 Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002).

These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."

^d For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).
 For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).
 Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested."

CV	Coefficient of variation ((SD/mean)*100)	Q95	95th percentile (quantile)
Min	Minimum concentration reported	SD	Standard deviation
Max	Maximum concentration reported	UCL ₉₅	The one-sided 95 percent upper confidence limit of the mean
MVUE	Minimum variance unbiased estimate	Unknown[a]	Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms
N/A	Not applicable	Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.
 U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term." Intermittent Bulletin, Volume 1, Number 1, Publication 9285.7-081.
 EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10, Washington, D.C. December 2002.

TABLE B-10: SUMMARY STATISTICS FOR MALTA & O'SHAUGHNESSY, SOIL MATRIX

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
											Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d
		Detected	Total		Min	Max	Min	Max								
Aluminum	Normal	15	15	100	N/A	N/A	1.74E+03	1.68E+04	1.33E+04	1.68E+04	1.10E+04	5.26E+03	48	1.34E+04		
Antimony	Not Tested	0	15	0	1.00E+01	1.10E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Lognormal	15	15	100	N/A	N/A	3.20E+00	1.97E+01	7.70E+00	1.97E+01	8.14E+00	1.00E+00	12	1.06E+01		
Barium	Lognormal	15	15	100	N/A	N/A	1.73E+02	1.32E+03	5.39E+02	1.32E+03	6.50E+02	9.11E+01	14	8.81E+02		
Beryllium	Not Tested	0	15	0	1.30E-01	5.60E-01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Cadmium	Not Tested	4	15	27	4.00E-02	1.90E-01	2.80E-01	4.50E-01	1.40E-01	4.50E-01	1.38E-01	1.46E-01	105	3.08E-01		
Calcium	Lognormal	15	15	100	N/A	N/A	7.66E+02	3.79E+03	2.34E+03	3.79E+03	2.22E+03	3.34E+02	15	3.09E+03		
Chromium	Normal	15	15	100	N/A	N/A	2.70E+00	3.83E+01	2.88E+01	3.83E+01	2.55E+01	1.17E+01	46	3.08E+01		
Cobalt	Normal	15	15	100	N/A	N/A	1.90E+00	3.03E+01	2.39E+01	3.03E+01	1.97E+01	9.16E+00	46	2.39E+01		
Copper	Lognormal	15	15	100	N/A	N/A	3.22E+01	2.69E+02	1.07E+02	2.69E+02	1.20E+02	1.75E+01	15	1.65E+02		
Iron	Normal	15	15	100	N/A	N/A	4.34E+03	8.85E+04	6.18E+04	8.85E+04	5.71E+04	2.43E+04	43	6.82E+04		
Lead	Normal	15	15	100	N/A	N/A	3.30E+00	9.37E+01	5.20E+01	9.37E+01	5.42E+01	2.40E+01	44	6.51E+01		
Magnesium	Unknown[a]	15	15	100	N/A	N/A	3.85E+02	6.31E+03	4.76E+03	6.31E+03	3.55E+03	2.16E+03	61	4.54E+03		
Manganese	Lognormal	15	15	100	N/A	N/A	2.00E+03	2.21E+04	8.07E+03	2.21E+04	8.23E+03	1.37E+03	17	1.20E+04		
Mercury	Lognormal	10	15	67	7.90E-02	1.00E-01	1.10E-01	2.80E-01	1.30E-01	2.80E-01	1.40E-01	3.33E-02	24	5.57E-01		
Molybdenum	Not Tested	0	15	0	5.10E+00	5.60E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Nickel	Normal	15	15	100	N/A	N/A	1.36E+01	1.01E+02	5.63E+01	1.01E+02	5.11E+01	2.43E+01	47	6.21E+01		
Potassium	Normal	15	15	100	N/A	N/A	1.19E+02	2.02E+03	1.25E+03	2.02E+03	1.20E+03	4.76E+02	40	1.41E+03		
Selenium	Lognormal	14	15	93	1.00E+00	1.00E+00	1.40E+00	9.20E+00	2.70E+00	9.20E+00	3.41E+00	6.04E-01	18	5.14E+00		
Silver	Lognormal	12	15	80	1.20E-01	4.10E-01	5.50E-01	2.60E+00	8.10E-01	2.60E+00	1.06E+00	3.34E-01	31	5.07E+00		
Sodium	Not Tested	0	15	0	5.10E+03	5.60E+03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Thallium	Not Tested	0	15	0	1.00E+01	1.10E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Vanadium	Normal	15	15	100	N/A	N/A	9.00E+00	1.56E+02	1.12E+02	1.56E+02	9.53E+01	4.79E+01	50	1.17E+02		
Zinc	Normal	15	15	100	N/A	N/A	1.25E+01	1.46E+02	1.12E+02	1.46E+02	9.78E+01	4.14E+01	42	1.17E+02		

Notes:

Concentration units are mg/kg

For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.

For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002)

Details of the approach used for performing all calculations are contained in the methods section of this report.

For samples with zero detections, only the minimum and maximum reporting limit are reported.

a

For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).

Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."

For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms

Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b

For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).

c

For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae.

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following

equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).

Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002)

These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."

d

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987)

Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach

described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed

or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested"

CV

Coefficient of variation ((SD/mean)*100)

Q95

95th percentile (quantile)

Min

Minimum concentration reported

SD

Standard deviation

Max

Maximum concentration reported

UCL₉₅

The one-sided 95 percent upper confidence limit of the mean

MVUE

Minimum variance unbiased estimate

Unknown[a]

Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.

N/A

Not applicable

Unknown[b]

Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285 7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

TABLE B-11: SUMMARY STATISTICS FOR ALL CHERT SITES AND MATRICES COMBINED

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
											Detected	Total	Min	Max	Min	Max
Aluminum	Unknown[a]	67	67	100	N/A	N/A	1.74E+03	3.56E+04	1.57E+04	3.09E+04	1.44E+04	8.02E+03	56	1.60E+04		
Antimony	Not Tested	0	67	0	3.10E-01	4.60E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Lognormal	65	67	97	1.00E+01	1.00E+01	1.30E+00	3.79E+01	7.80E+00	3.30E+01	1.17E+01	1.19E+00	10	1.42E+01		
Barium	Lognormal	67	67	100	N/A	N/A	1.39E+02	4.39E+03	5.39E+02	2.42E+03	7.40E+02	6.99E+01	9	8.84E+02		
Beryllium	Not Tested	2	67	3	1.30E-01	2.30E+00	1.50E-01	3.80E-01	5.50E-01	2.30E+00	6.38E-01	5.97E-01	94	1.07E+00		
Cadmium	Not Tested	16	67	24	1.60E-02	2.30E+00	1.80E-01	7.40E-01	3.20E-01	2.20E+00	2.77E-01	3.83E-01	138	5.71E-01		
Calcium	Lognormal	67	67	100	N/A	N/A	2.21E+02	3.79E+03	1.24E+03	3.42E+03	1.38E+03	1.22E+02	9	1.63E+03		
Chromium	Unknown[a]	67	67	100	N/A	N/A	2.70E+00	7.71E+01	3.47E+01	6.48E+01	3.30E+01	2.00E+01	61	3.71E+01		
Cobalt	Lognormal	67	67	100	N/A	N/A	1.90E+00	7.44E+01	1.95E+01	5.22E+01	2.26E+01	2.01E+00	9	2.67E+01		
Copper	Unknown[a]	67	67	100	N/A	N/A	2.91E+01	3.36E+02	1.19E+02	2.85E+02	1.30E+02	7.46E+01	57	1.45E+02		
Iron	Unknown[a]	67	67	100	N/A	N/A	4.34E+03	2.03E+05	5.96E+04	1.09E+05	6.03E+04	3.11E+04	51	6.66E+04		
Lead	Normal	67	67	100	N/A	N/A	3.30E+00	9.37E+01	3.60E+01	7.51E+01	3.84E+01	1.95E+01	51	4.24E+01		
Magnesium	Lognormal	67	67	100	N/A	N/A	3.85E+02	1.19E+04	2.32E+03	6.31E+03	2.53E+03	2.47E+02	10	3.04E+03		
Manganese	Unknown[b]	67	67	100	N/A	N/A	3.66E+02	4.05E+04	7.40E+03	2.22E+04	9.90E+03	1.96E+03	20	1.48E+04		
Mercury	Lognormal	61	67	91	2.00E-02	1.00E-01	2.50E-02	3.70E-01	9.90E-02	2.76E-01	1.09E-01	9.80E-03	9	1.29E-01		
Molybdenum	Not Tested	8	67	12	1.60E-01	2.30E+01	3.40E-01	1.40E+00	5.20E+00	2.20E+01	4.76E+00	5.42E+00	114	8.76E+00		
Nickel	Unknown[a]	67	67	100	N/A	N/A	1.02E+01	1.43E+02	5.94E+01	1.16E+02	5.65E+01	3.34E+01	59	6.33E+01		
Potassium	Unknown[b]	67	67	100	N/A	N/A	1.19E+02	3.34E+03	1.11E+03	3.09E+03	1.48E+03	1.76E+02	12	1.87E+03		
Selenium	Lognormal	53	67	79	3.50E-01	5.00E+00	9.00E-01	2.33E+01	3.20E+00	1.31E+01	5.33E+00	1.10E+00	21	1.49E+01		
Silver	Unknown[b]	42	67	63	8.80E-02	2.30E+01	2.40E-01	2.60E+00	1.00E+00	2.30E+01	3.89E+00	1.13E+00	29	1.40E+01		
Sodium	Not Tested	0	67	0	6.41E+01	1.00E+04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Thallium	Not Tested	10	67	15	6.70E-01	4.60E+01	7.20E-01	2.30E+00	1.00E+01	4.50E+01	1.01E+01	1.14E+01	113	1.84E+01		
Vanadium	Lognormal	67	67	100	N/A	N/A	9.00E+00	3.56E+02	7.74E+01	3.07E+02	1.01E+02	1.11E+01	11	1.25E+02		
Zinc	Unknown[b]	67	67	100	N/A	N/A	9.00E+00	2.67E+02	6.23E+01	1.69E+02	8.70E+01	7.39E+00	8	1.02E+02		

Notes

Concentration units are mg/kg

For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated.

For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002).

Details of the approach used for performing all calculations are contained in the methods section of this report.

For samples with zero detections, only the minimum and maximum reporting limit are reported.

a

For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05).

Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested."

For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms.

Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively.

b

For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data).

c

For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae.

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following

equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).

Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002).

These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."

d

For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987).

For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987).

Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested".

CV

Coefficient of variation ((SD/mean)*100)

Min

Minimum concentration reported

Max

Maximum concentration reported

MVUE

Minimum variance unbiased estimate

N/A

Not applicable

Q95

95th percentile (quantile)

SD

Standard deviation

UCL₉₅

The one-sided 95 percent upper confidence limit of the mean

Unknown[a]

Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.

Unknown[b]

Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:

Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.

U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285 7-081.

EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

TABLE B-12: SUMMARY STATISTICS FOR ALL CHERT SITES, ROCK MATRIX
Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
				Detected	Total		Min	Max	Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d
Aluminum	Lognormal	35	35	100	N/A	N/A	2.01E+03	3.56E+04	9.19E+03	3.32E+04	1.42E+04	2.12E+03	15	1.94E+04		
Antimony	Not Tested	0	35	0	3.10E-01	4.00E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Unknown[a]	33	35	94	1.00E+01	1.00E+01	1.30E+00	3.79E+01	1.58E+01	3.49E+01	1.67E+01	1.03E+01	62	1.96E+01		
Barium	Lognormal	35	35	100	N/A	N/A	1.39E+02	4.39E+03	7.05E+02	2.98E+03	1.01E+03	1.41E+02	14	1.35E+03		
Beryllium	Not Tested	2	35	6	5.00E-01	2.00E+00	1.50E-01	3.80E-01	5.00E-01	2.00E+00	5.69E-01	5.44E-01	96	1.14E+00		
Cadmium	Not Tested	12	35	34	1.60E-02	5.00E-01	1.80E-01	7.40E-01	4.10E-01	5.88E-01	2.45E-01	1.77E-01	72	4.02E-01		
Calcium	Normal	35	35	100	N/A	N/A	2.21E+02	2.04E+03	8.89E+02	1.65E+03	8.46E+02	4.26E+02	50	9.67E+02		
Chromium	Unknown[b]	35	35	100	N/A	N/A	3.10E+00	7.71E+01	1.48E+01	7.11E+01	2.81E+01	4.70E+00	17	4.02E+01		
Cobalt	Lognormal	35	35	100	N/A	N/A	4.40E+00	7.44E+01	2.69E+01	6.36E+01	2.92E+01	3.40E+00	12	3.68E+01		
Copper	Lognormal	35	35	100	N/A	N/A	6.18E+01	3.36E+02	1.73E+02	3.34E+02	1.77E+02	1.04E+01	6	1.97E+02		
Iron	Unknown[a]	35	35	100	N/A	N/A	1.02E+04	2.03E+05	7.12E+04	1.42E+05	7.02E+04	3.68E+04	52	8.07E+04		
Lead	Lognormal	35	35	100	N/A	N/A	8.80E+00	7.73E+01	2.82E+01	5.87E+01	3.06E+01	2.98E+00	10	3.69E+01		
Magnesium	Lognormal	35	35	100	N/A	N/A	3.88E+02	1.19E+04	1.63E+03	8.83E+03	2.09E+03	2.97E+02	14	2.80E+03		
Manganese	Lognormal	35	35	100	N/A	N/A	4.12E+03	4.05E+04	9.02E+03	2.69E+04	1.16E+04	1.14E+03	10	1.41E+04		
Mercury	Lognormal	35	35	100	N/A	N/A	2.50E-02	3.70E-01	7.30E-02	3.22E-01	1.02E-01	1.35E-02	13	1.34E-01		
Molybdenum	Not Tested	2	35	6	1.90E-01	2.00E+01	7.70E-01	1.40E+00	5.00E+00	2.00E+01	5.31E+00	5.44E+00	102	1.10E+01		
Nickel	Lognormal	35	35	100	N/A	N/A	2.32E+01	1.43E+02	6.99E+01	1.33E+02	7.75E+01	5.04E+00	6	8.74E+01		
Potassium	Unknown[a]	35	35	100	N/A	N/A	1.35E+02	2.29E+03	7.56E+02	1.97E+03	7.88E+02	4.62E+02	59	9.19E+02		
Selenium	Unknown[a]	27	35	77	3.50E-01	5.00E+00	1.80E+00	2.33E+01	5.30E+00	1.66E+01	6.50E+00	5.10E+00	78	8.08E+00		
Silver	Unknown[b]	30	35	86	8.80E-02	2.00E+01	2.40E-01	1.60E+00	6.30E-01	8.00E+00	1.01E+00	1.98E-01	20	1.56E+00		
Sodium	Not Tested	0	35	0	6.41E+01	1.00E+04	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Thallium	Not Tested	10	35	29	6.70E-01	4.00E+01	7.20E-01	2.30E+00	1.00E+01	4.00E+01	6.40E+00	8.24E+00	129	1.56E+01		
Vanadium	Unknown[b]	35	35	100	N/A	N/A	1.49E+01	3.56E+02	5.42E+01	3.42E+02	1.15E+02	2.17E+01	19	1.74E+02		
Zinc	Lognormal	35	35	100	N/A	N/A	9.00E+00	2.67E+02	7.91E+01	1.99E+02	9.97E+01	1.33E+01	13	1.31E+02		

Notes: Concentration units are mg/kg
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002)
Details of the approach used for performing all calculations are contained in the methods section of this report
For samples with zero detections, only the minimum and maximum reporting limit are reported

- a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05). Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested." For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms. Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively
- b For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data)
- c For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae
For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987)
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002)
These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."
- d For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987)
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987)
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested".

CV	Coefficient of variation ((SD/mean)*100)	Q95	95th percentile (quantile)
Min	Minimum concentration reported	SD	Standard deviation
Max	Maximum concentration reported	UCL ₉₅	The one-sided 95 percent upper confidence limit of the mean
MVUE	Minimum variance unbiased estimate	Unknown[a]	Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.
N/A	Not applicable	Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:
Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.
U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081
EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

TABLE B-13: SUMMARY STATISTICS FOR ALL CHERT SITES, SOIL MATRIX
Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Chemical		Distribution ^a		SUMMARY STATISTICS												
				Sample Size		Detection Frequency (Percent)	Censored Data		Detected Data		Detected and Censored Data					
											Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d
Detected	Total	Min	Max	Min	Max	Median ^b	Q95 ^b	Mean ^c	SD ^c	CV	UCL ₉₅ ^d					
Aluminum	Unknown[a]	32	32	100	N/A	N/A	1.74E+03	2.14E+04	1.63E+04	2.11E+04	1.49E+04	5.48E+03	37	1.65E+04		
Antimony	Not Tested	0	32	0	1.00E+01	4.60E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Arsenic	Lognormal	32	32	100	N/A	N/A	2.20E+00	1.97E+01	5.55E+00	1.39E+01	6.40E+00	4.93E-01	8	7.39E+00		
Barium	Lognormal	32	32	100	N/A	N/A	1.73E+02	1.32E+03	4.04E+02	1.22E+03	4.77E+02	4.32E+01	9	5.67E+02		
Beryllium	Not Tested	0	32	0	1.30E-01	2.30E+00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Cadmium	Not Tested	4	32	12	3.90E-02	2.30E+00	2.80E-01	4.50E-01	1.25E-01	2.30E+00	3.19E-01	5.32E-01	167	9.16E-01		
Calcium	Lognormal	32	32	100	N/A	N/A	7.65E+02	3.79E+03	1.75E+03	3.67E+03	1.91E+03	1.45E+02	8	2.20E+03		
Chromium	Unknown[a]	32	32	100	N/A	N/A	2.70E+00	5.73E+01	4.19E+01	5.72E+01	3.92E+01	1.61E+01	41	4.40E+01		
Cobalt	Unknown[a]	32	32	100	N/A	N/A	1.90E+00	3.03E+01	1.24E+01	3.01E+01	1.54E+01	7.52E+00	49	1.76E+01		
Copper	Unknown[b]	32	32	100	N/A	N/A	2.91E+01	2.69E+02	4.95E+01	2.05E+02	7.86E+01	8.30E+00	11	9.65E+01		
Iron	Normal	32	32	100	N/A	N/A	4.34E+03	8.85E+04	4.61E+04	8.63E+04	4.95E+04	1.83E+04	37	5.50E+04		
Lead	Normal	32	32	100	N/A	N/A	3.30E+00	9.37E+01	4.52E+01	8.32E+01	4.74E+01	1.98E+01	42	5.33E+01		
Magnesium	Unknown[b]	32	32	100	N/A	N/A	3.85E+02	6.31E+03	2.42E+03	6.30E+03	2.95E+03	3.35E+02	11	3.69E+03		
Manganese	Unknown[b]	32	32	100	N/A	N/A	3.66E+02	2.21E+04	8.25E+02	1.51E+04	4.24E+03	1.15E+03	27	8.09E+03		
Mercury	Unknown[b]	26	32	81	2.00E-02	1.00E-01	7.40E-02	2.80E-01	1.10E-01	2.74E-01	1.22E-01	1.85E-02	15	3.36E-01		
Molybdenum	Not Tested	6	32	19	1.60E-01	2.30E+01	3.40E-01	5.40E-01	5.25E+00	2.30E+01	4.09E+00	5.31E+00	130	1.00E+01		
Nickel	Unknown[b]	32	32	100	N/A	N/A	1.02E+01	1.01E+02	2.06E+01	8.20E+01	3.34E+01	3.85E+00	12	4.19E+01		
Potassium	Unknown[a]	32	32	100	N/A	N/A	1.19E+02	3.34E+03	2.18E+03	3.20E+03	2.06E+03	9.23E+02	45	2.33E+03		
Selenium	Lognormal	26	32	81	5.10E-01	1.00E+00	9.00E-01	9.20E+00	1.40E+00	7.38E+00	2.32E+00	5.02E-01	22	7.91E+00		
Silver	Not Tested	12	32	38	1.20E-01	2.30E+01	5.50E-01	2.60E+00	2.15E+01	2.30E+01	6.32E+00	7.03E+00	111	1.39E+01		
Sodium	Not Tested	0	32	0	2.10E+03	5.60E+03	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Thallium	Not Tested	0	32	0	1.00E+01	4.60E+01	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
Vanadium	Normal	32	32	100	N/A	N/A	9.00E+00	1.56E+02	7.94E+01	1.51E+02	8.46E+01	3.46E+01	41	9.50E+01		
Zinc	Unknown[b]	32	32	100	N/A	N/A	1.25E+01	1.46E+02	5.72E+01	1.42E+02	7.42E+01	7.34E+00	10	8.98E+01		

Notes: Concentration units are mg/kg
For samples with less than 15 percent censored data, one half the reporting limit is substituted for each non-detect measurement in all calculations unless otherwise indicated
For higher frequencies of censored data, all calculations were performed using stochastic modeling, following the "bounding" approach presented in EPA (2002)
Details of the approach used for performing all calculations are contained in the methods section of this report
For samples with zero detections, only the minimum and maximum reporting limit are reported

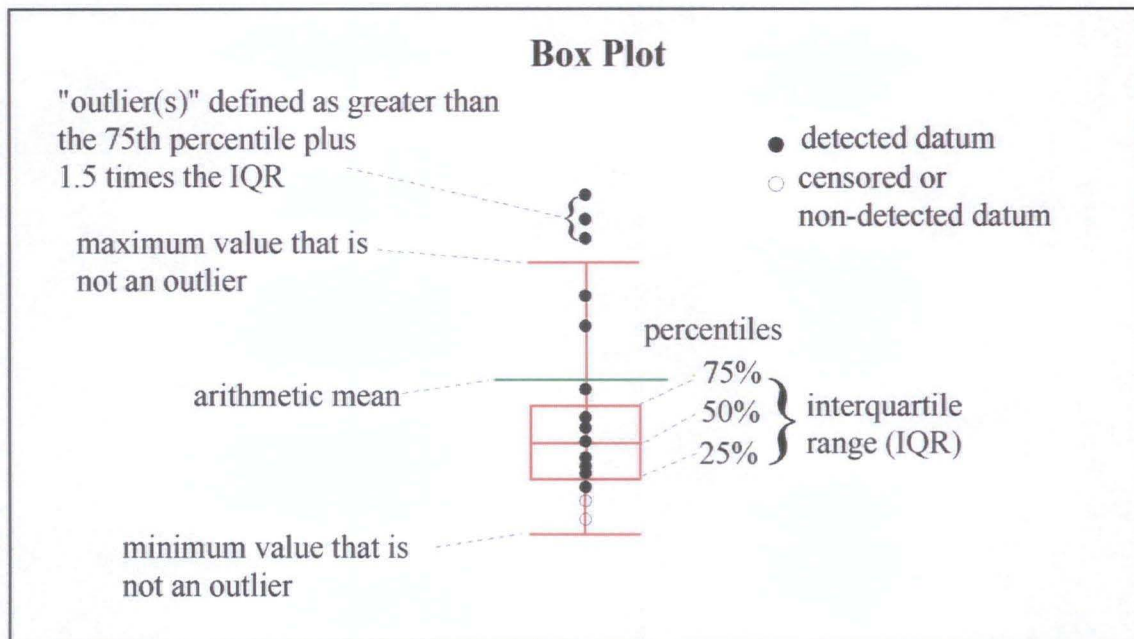
- a For all cases with at least 5 detected samples and a detection frequency greater than or equal to 50 percent, tested using the Shapiro-Wilk W test (alpha equal to 0.05). Distributions confirmed as normal or lognormal are listed as "Normal" or "Lognormal." For cases where distribution testing was not conducted, the distribution is listed as "Not Tested." For cases in which distributions could not be confirmed using the Shapiro-Wilk W test, distributions were estimated using probability plots, box plots, and frequency histograms. Distributions estimated to be normal or lognormal are listed as Unknown[a] or Unknown[b], respectively
- b For sample-sizes greater than two with at least one detection, estimated using a nonparametric approach, based on rank ordering of the data (reported values used for all censored data)
- c For sample-sizes greater than two with at least one detection, calculated using distribution-dependent formulae
For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equations 4.3 (mean) and 4.4 (standard deviation) in Gilbert (1987)
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, these are the minimum variance unbiased (MVU) estimators, following equations 13.3 (mean) and 13.5 (standard deviation) in Gilbert (1987).
Calculations for all cases with greater than 15 percent censored data use the median values generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002)
These calculations are based on 1) the arithmetic mean and SD for confirmed or assumed normal distributions, 2) the MVUE of the mean and SD for confirmed or assumed lognormal distributions, and 3) the arithmetic mean and SD when the distribution is listed as "Not Tested."
- d For confirmed or estimated normal distributions with no more than 15 percent censored data, calculated using equation 11.6 in Gilbert (1987)
For confirmed or estimated lognormal distributions with no more than 15 percent censored data, calculated using Land's method (EPA 1992, Gilbert 1987)
Calculations for all cases with greater than 15 percent censored data use the 95th percentile generated from 2,000 iterations of a Monte Carlo model, following the "bounding" approach described in EPA (2002). These calculations are based on 1) the t statistic for confirmed or assumed normal distributions, 2) the MVUE Chebyshev inequality for confirmed or assumed lognormal distributions, and 3) the nonparametric Chebyshev inequality when the distribution is listed as "Not Tested".

CV	Coefficient of variation ((SD/mean)*100)	Q95	95th percentile (quantile)
Min	Minimum concentration reported	SD	Standard deviation
Max	Maximum concentration reported	UCL ₉₅	The one-sided 95 percent upper confidence limit of the mean
MVUE	Minimum variance unbiased estimate	Unknown[a]	Distribution assumed to be normal based on examination of probability plots, outlier box-plots, and frequency histograms.
N/A	Not applicable	Unknown[b]	Distribution assumed to be lognormal based on examination of probability plots, outlier box-plots, and frequency histograms.

Sources:
Gilbert, R. O. 1987. *Statistical Methods for Environmental Pollution Monitoring*. John Wiley & Sons, Inc., New York, NY.
U.S. Environmental Protection Agency (EPA). 1992. "Supplemental Guidance to RAGS: Calculating the Concentration Term". Intermittent Bulletin, Volume 1, Number 1. Publication 9285.7-081
EPA. 2002. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." OSWER 9285.6-10. Washington, D.C. December 2002.

ATTACHMENT B1
BOX PLOTS

KEY FOR INTERPRETING BOX PLOTS

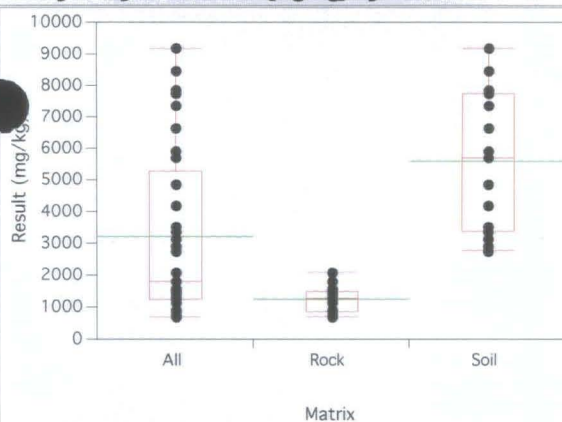


Individual Sites - All Metals

By matrix, separately and combined

Site-Innes Avenue, Chemical-Aluminum

Oneway Analysis of Result (mg/kg) By Matrix

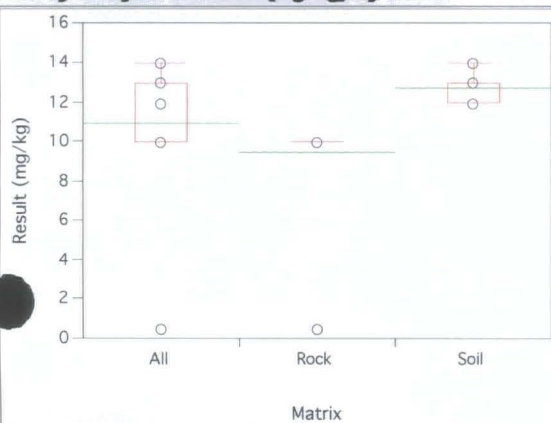


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	689	785.8	1240	1800	5265	7804	9180
Rock	689	736.7	858.25	1265	1480	1830	2100
Soil	2770	2866	3370	5680	7750	8772	9180

Site-Innes Avenue, Chemical-Antimony

Oneway Analysis of Result (mg/kg) By Matrix

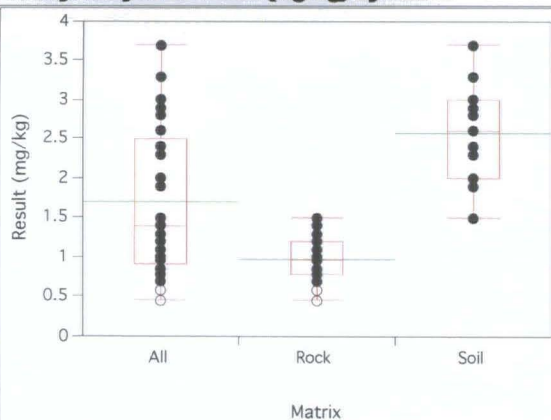


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.46	10	10	10	13	13	14
Rock	0.46	9.046	10	10	10	10	10
Soil	12	12	12	13	13	14	14

Site-Innes Avenue, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Matrix

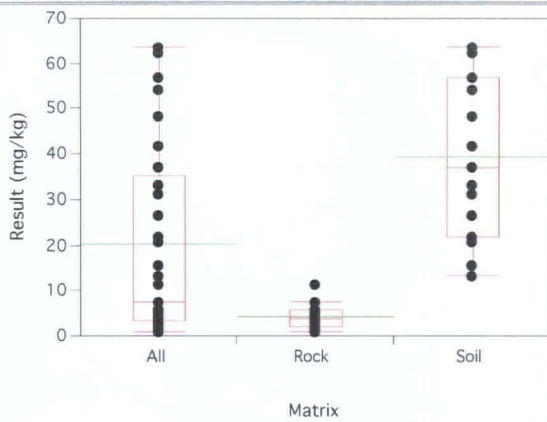


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.46	0.726	0.91	1.4	2.5	3	3.7
Rock	0.46	0.577	0.78	0.965	1.2	1.41	1.5
Soil	1.5	1.74	2	2.6	3	3.46	3.7

Site-Innes Avenue, Chemical-Barium

Oneway Analysis of Result (mg/kg) By Matrix

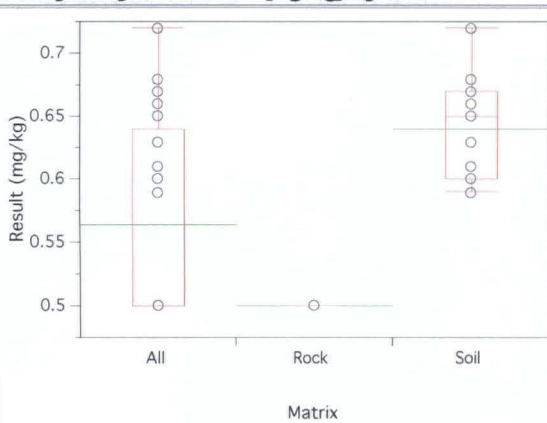


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.94	1.5	3.5	7.6	35.15	60.22	63.6
Rock	0.94	0.994	2.025	3.8	5.75	7.98	11.4
Soil	13.4	14.72	21.8	37	56.8	63.6	63.6

Site-Innes Avenue, Chemical-Beryllium

Oneway Analysis of Result (mg/kg) By Matrix

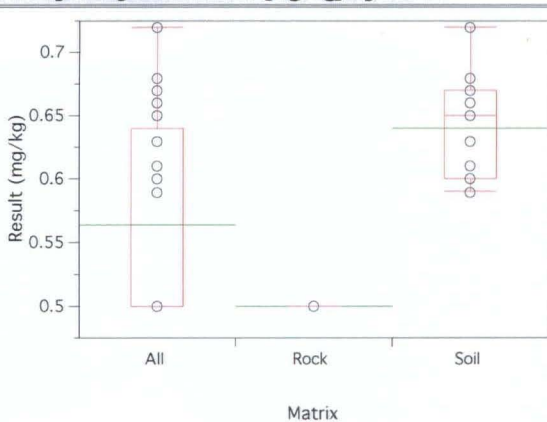


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.5	0.5	0.5	0.5	0.64	0.67	0.72
Rock	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Soil	0.59	0.59	0.6	0.65	0.67	0.696	0.72

Site-Innes Avenue, Chemical-Cadmium

Oneway Analysis of Result (mg/kg) By Matrix

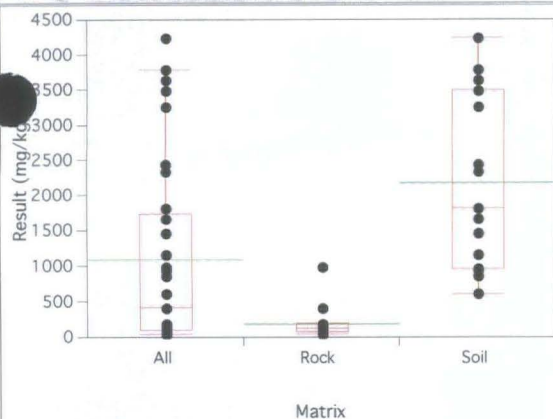


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.5	0.5	0.5	0.5	0.64	0.67	0.72
Rock	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Soil	0.59	0.59	0.6	0.65	0.67	0.696	0.72

Site-Innes Avenue, Chemical-Calcium

Oneway Analysis of Result (mg/kg) By Matrix

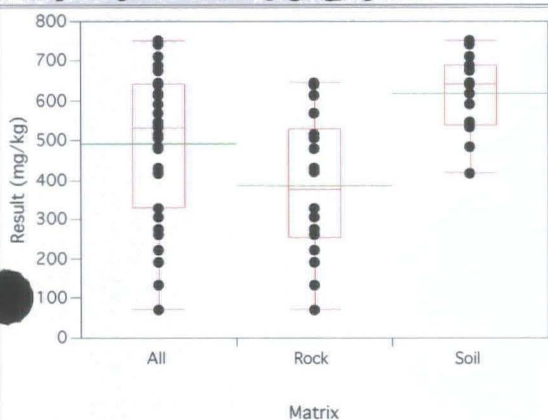


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	43.2	58.62	104.5	419	1740	3590	4240
Rock	43.2	50.67	78.675	126.5	197.75	475.5	984
Soil	606	759	958	1820	3500	3970	4240

Site-Innes Avenue, Chemical-Chromium

Oneway Analysis of Result (mg/kg) By Matrix

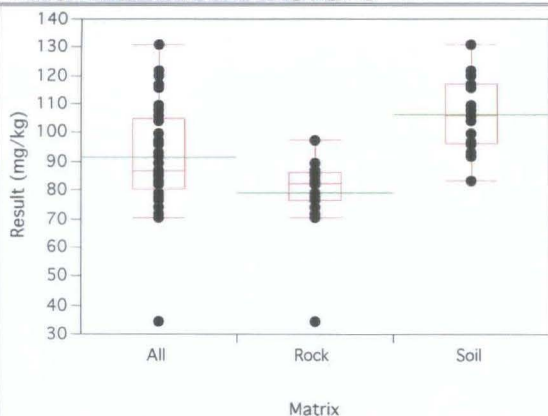


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	72.9	204.4	331.5	533	643.5	703.2	752
Rock	72.9	127.89	254.5	378	529.75	642.3	645
Soil	420	458.4	540	642	690	747.2	752

Site-Innes Avenue, Chemical-Cobalt

Oneway Analysis of Result (mg/kg) By Matrix

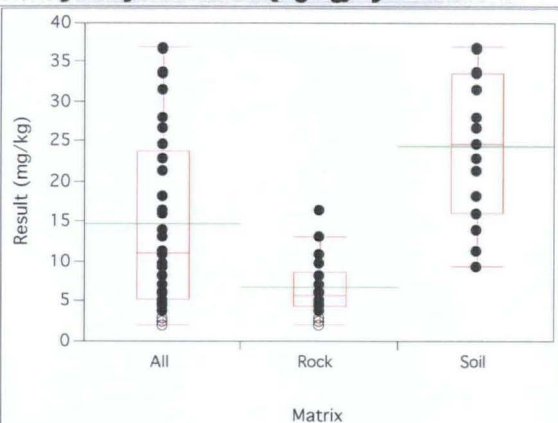


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	34.3	72.94	80.5	86.7	105	118.8	131
Rock	34.3	66.79	76.375	82.15	86.15	90.47	97.4
Soil	83.3	88.52	96.2	106	117	125.6	131

Site-Innes Avenue, Chemical-Copper

Oneway Analysis of Result (mg/kg) By Matrix

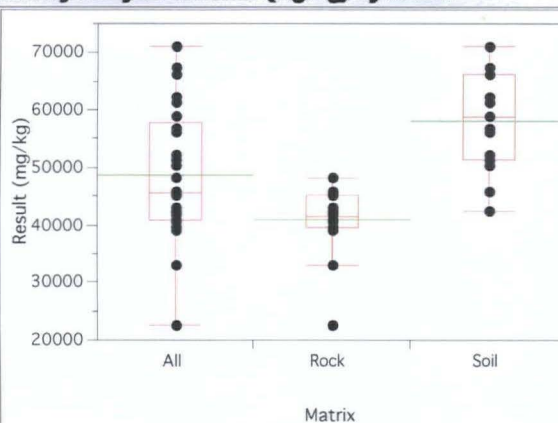


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2.1	3.38	5.3	11.1	23.85	33.72	37
Rock	2.1	2.55	4.4	5.7	8.625	13.45	16.6
Soil	9.4	10.66	16.1	24.7	33.6	36.88	37

Site-Innes Avenue, Chemical-Iron

Oneway Analysis of Result (mg/kg) By Matrix

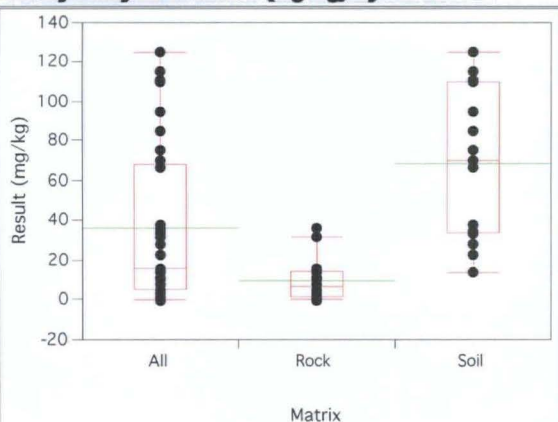


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	22600	38980	40850	45600	57850	66300	71100
Rock	22600	31870	39475	41400	45175	46120	48100
Soil	42400	44380	51300	58800	66300	68940	71100

Site-Innes Avenue, Chemical-Lead

Oneway Analysis of Result (mg/kg) By Matrix

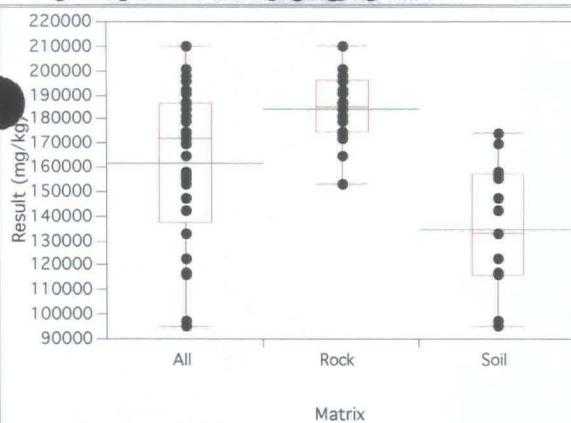


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.19	1.08	5.4	16.1	68.15	110.6	125
Rock	0.19	0.217	1.575	6.65	14.425	32.14	36.1
Soil	13.8	19.32	33.8	69.8	110	119	125

Site-Innes Avenue, Chemical-Magnesium

Oneway Analysis of Result (mg/kg) By Matrix

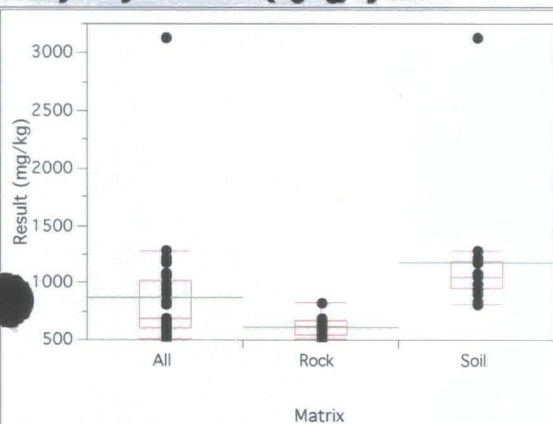


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	95200	116000	137500	172000	186500	197200	210000
Rock	153000	163800	174750	185000	196000	201900	210000
Soil	95200	96760	116000	133000	157000	171600	174000

Site-Innes Avenue, Chemical-Manganese

Oneway Analysis of Result (mg/kg) By Matrix

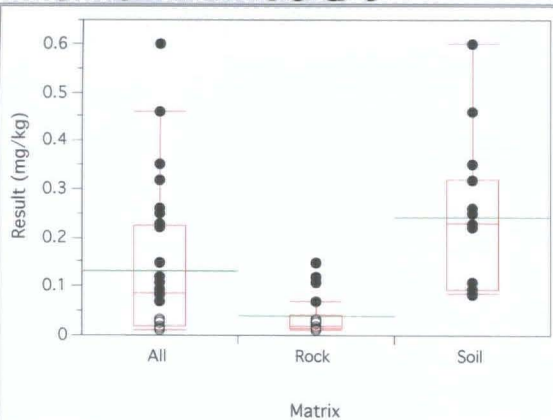


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	506	525.6	606	686	1022.5	1214	3130
Rock	506	520.4	543	616	667.25	700	826
Soil	812	830	953	1050	1190	2020	3130

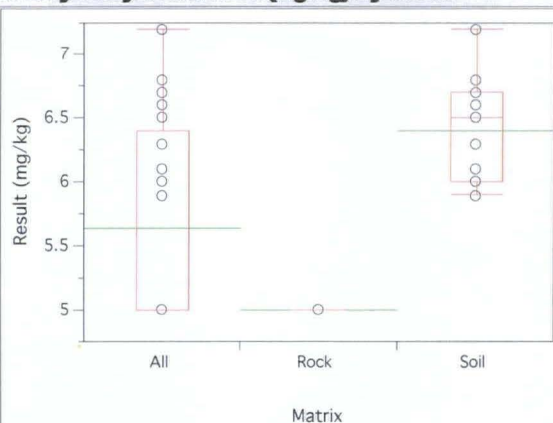
Site-Innes Avenue, Chemical-Mercury

Oneway Analysis of Result (mg/kg) By Matrix

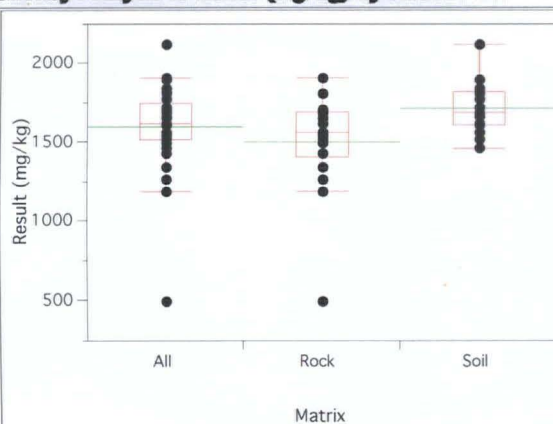


Quantiles

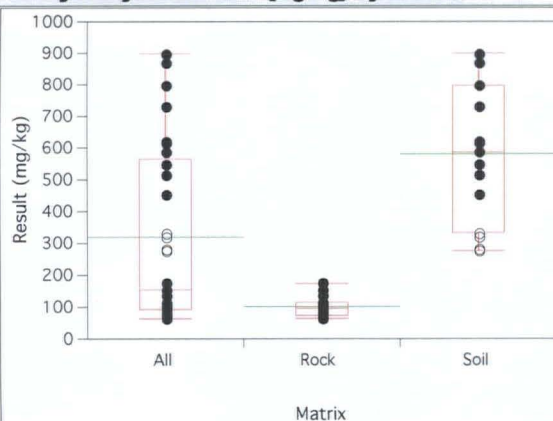
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.011	0.0124	0.019	0.087	0.225	0.338	0.6
Rock	0.011	0.011	0.0145	0.0195	0.042	0.123	0.15
Soil	0.086	0.0866	0.094	0.23	0.32	0.516	0.6

Site-Innes Avenue, Chemical-Molybdenum**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	5	5	5	5	6.4	6.7	7.2
Rock	5	5	5	5	5	5	5
Soil	5.9	5.9	6	6.5	6.7	6.96	7.2

Site-Innes Avenue, Chemical-Nickel**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

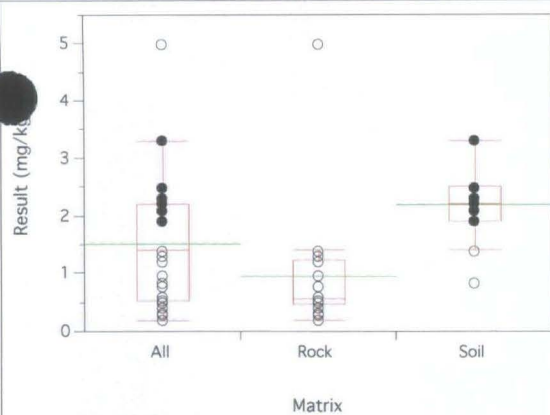
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	499	1292	1520	1620	1750	1876	2120
Rock	499	1120.9	1407.5	1565	1692.5	1820	1910
Soil	1460	1496	1610	1690	1820	1988	2120

Site-Innes Avenue, Chemical-Potassium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	64.1	70	93.05	155	566	840.4	899
Rock	64.1	66.8	73.6	96.55	114.25	156.9	174
Soil	275	279.2	332	586	796	882.2	899

Site-Innes Avenue, Chemical-Selenium

Oneway Analysis of Result (mg/kg) By Matrix

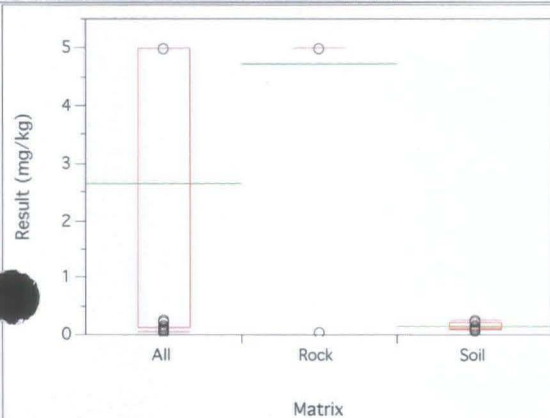


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.18	0.356	0.53	1.4	2.2	3.3	5
Rock	0.18	0.27	0.47	0.565	1.225	1.76	5
Soil	0.85	1.18	1.9	2.2	2.5	3.3	3.3

Site-Innes Avenue, Chemical-Silver

Oneway Analysis of Result (mg/kg) By Matrix

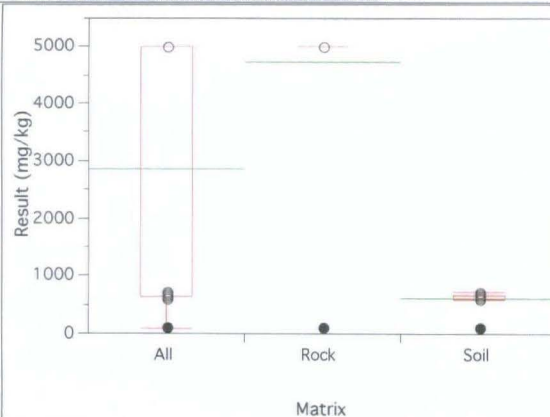


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.052	0.0912	0.125	5	5	5	5
Rock	0.052	4.5052	5	5	5	5	5
Soil	0.086	0.0872	0.1	0.13	0.21	0.26	0.26

Site-Innes Avenue, Chemical-Sodium

Oneway Analysis of Result (mg/kg) By Matrix

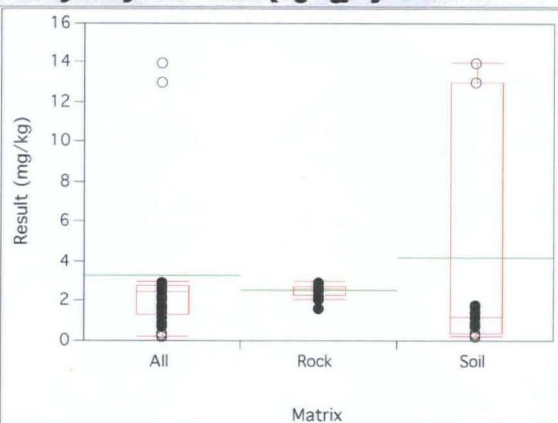


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	85.7	594	640	5000	5000	5000	5000
Rock	106	4510.6	5000	5000	5000	5000	5000
Soil	85.7	388.28	600	650	670	696	720

Site-Innes Avenue, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Matrix

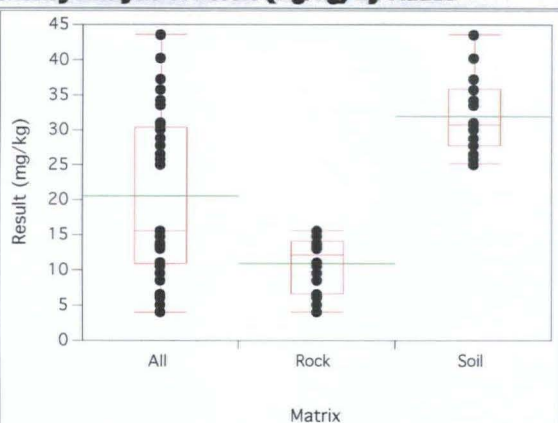


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.21	0.34	1.35	2.5	2.8	13	14
Rock	1.6	2.05	2.3	2.65	2.75	3	3
Soil	0.21	0.21	0.37	1.2	13	13.4	14

Site-Innes Avenue, Chemical-Vanadium

Oneway Analysis of Result (mg/kg) By Matrix

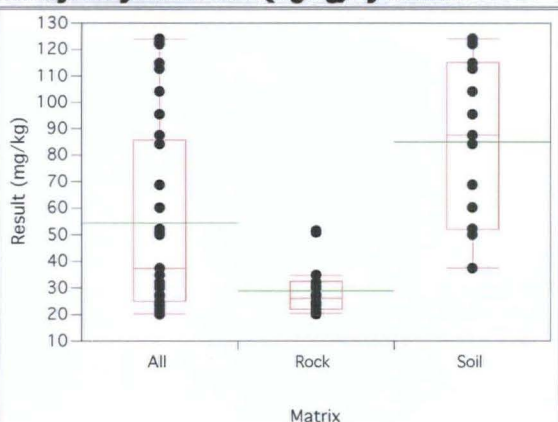


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	4	6.18	10.9	15.6	30.4	36.8	43.6
Rock	4	4.9	6.6	12.15	14.075	15.6	15.6
Soil	25.2	25.62	27.8	30.8	35.9	41.68	43.6

Site-Innes Avenue, Chemical-Zinc

Oneway Analysis of Result (mg/kg) By Matrix

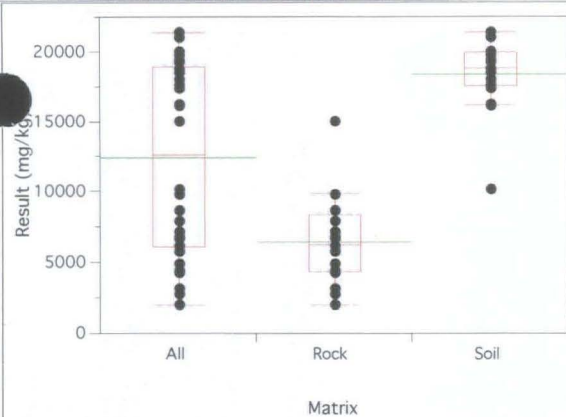


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	20.2	20.8	25.1	37.3	85.7	119.2	124
Rock	20.2	20.47	22	25.95	32.425	50.98	51.7
Soil	37.3	37.6	52	87.4	115	123.4	124

Site-Twin Peaks, Chemical-Aluminum

Oneway Analysis of Result (mg/kg) By Matrix

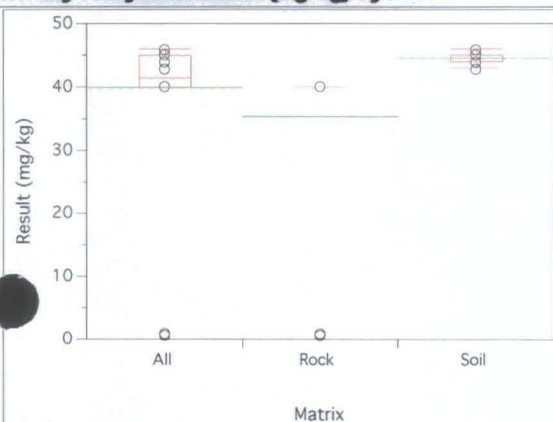


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2010	3745	6105	12600	18925	20100	21400
Rock	2010	2690	4310	6200	8325	10856	15000
Soil	10200	15000	17550	18800	19950	21080	21400

Site-Twin Peaks, Chemical-Antimony

Oneway Analysis of Result (mg/kg) By Matrix

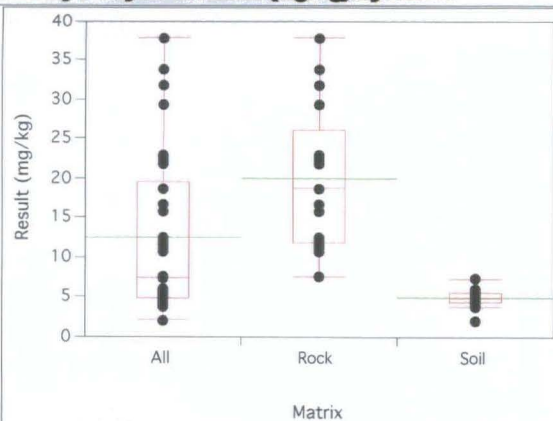


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.62	40	40	41.5	45	45	46
Rock	0.62	0.82	40	40	40	40	40
Soil	43	43	44	45	45	46	46

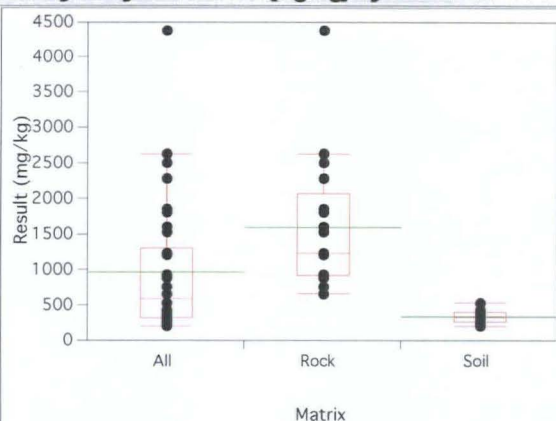
Site-Twin Peaks, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Matrix

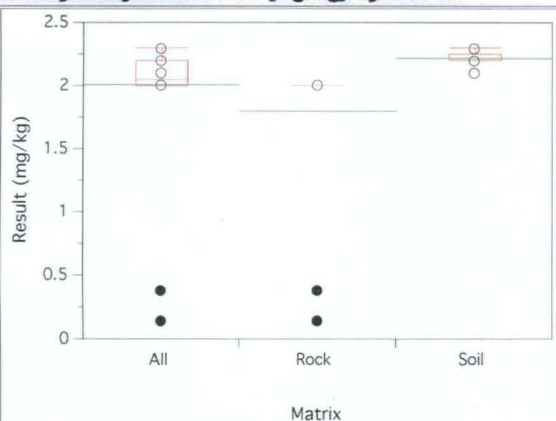


Quantiles

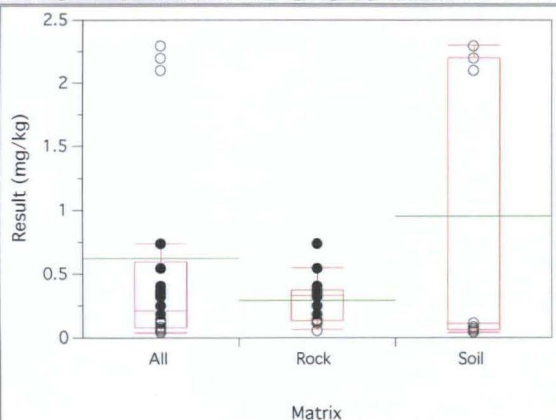
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2.2	4.2	4.9	7.45	19.575	30.6	37.9
Rock	7.6	10.16	11.85	18.8	26.15	34.62	37.9
Soil	2.2	3.48	4.4	4.9	5.6	6.26	7.3

Site-Twin Peaks, Chemical-Barium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	205	243	323.75	596.5	1307.5	2400	4390
Rock	658	735.6	916.5	1230	2070	2982	4390
Soil	205	227.4	261.5	330	404	449.4	535

Site-Twin Peaks, Chemical-Beryllium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

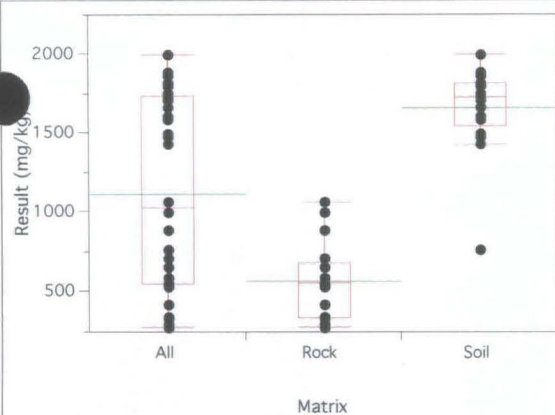
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.15	2	2	2.05	2.2	2.3	2.3
Rock	0.15	0.334	2	2	2	2	2
Soil	2.1	2.18	2.2	2.2	2.25	2.3	2.3

Site-Twin Peaks, Chemical-Cadmium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.039	0.0575	0.0795	0.215	0.5975	2.2	2.3
Rock	0.065	0.101	0.135	0.33	0.375	0.588	0.74
Soil	0.039	0.047	0.06	0.11	2.2	2.3	2.3

Site-Twin Peaks, Chemical-Calcium

Oneway Analysis of Result (mg/kg) By Matrix

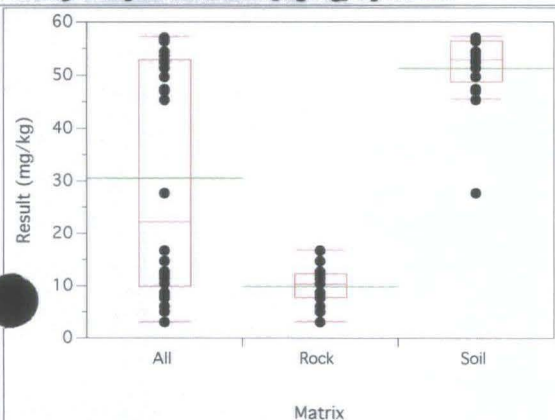


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	279	316	552.5	1030	1737.5	1845	2000
Rock	279	293.4	339	556	681.5	1012	1060
Soil	765	1297	1545	1730	1820	1912	2000

Site-Twin Peaks, Chemical-Chromium

Oneway Analysis of Result (mg/kg) By Matrix

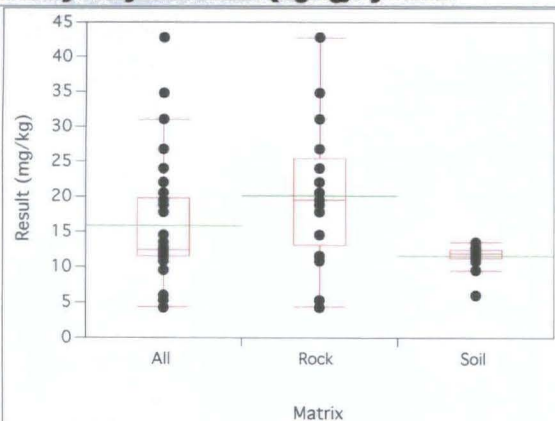


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	3.1	6.85	9.95	22.25	52.925	56.75	57.3
Rock	3.1	4.78	7.75	10.3	12.35	15.2	16.8
Soil	27.7	41.94	48.7	52.9	56.4	57.22	57.3

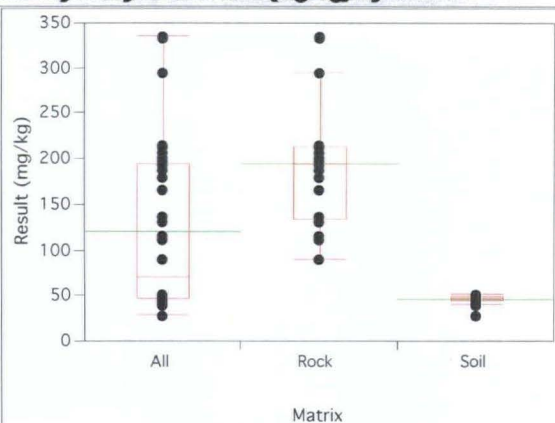
Site-Twin Peaks, Chemical-Cobalt

Oneway Analysis of Result (mg/kg) By Matrix

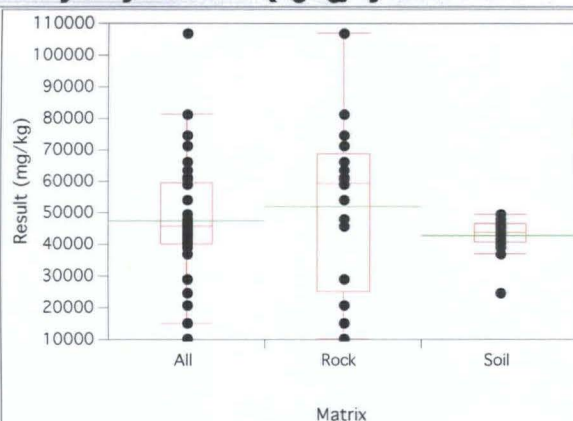


Quantiles

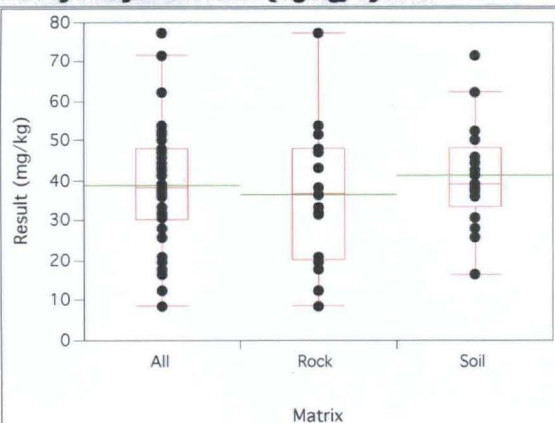
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	4.4	7.85	11.5	12.45	19.8	28.95	42.7
Rock	4.4	5.2	13.1	19.5	25.45	36.38	42.7
Soil	6.2	8.84	11.2	11.9	12.45	13.02	13.5

Site-Twin Peaks, Chemical-Copper**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	29.1	43.55	47.125	70.8	194.75	255	336
Rock	89.9	106.78	134	194	213.5	333.6	336
Soil	29.1	38.46	44.85	47.3	49.15	50.66	51.7

Site-Twin Peaks, Chemical-Iron**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

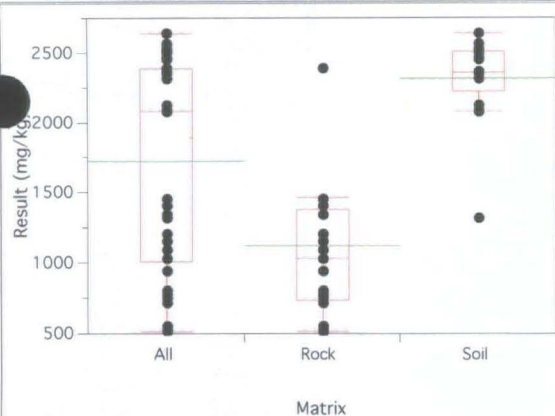
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	10200	17900	40075	45800	59650	73100	107000
Rock	10200	14120	25050	59300	68750	86600	107000
Soil	24900	34580	40650	43700	46550	48460	49500

Site-Twin Peaks, Chemical-Lead**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	8.8	17.15	30.35	38.4	48.125	58.2	77.3
Rock	8.8	12	20.3	36.8	48.15	58.66	77.3
Soil	16.4	23.92	33.5	39.1	48.2	64.28	71.8

Site-Twin Peaks, Chemical-Magnesium

Oneway Analysis of Result (mg/kg) By Matrix

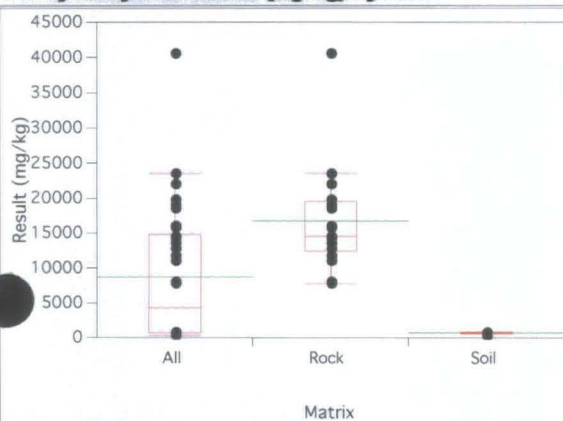


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	516	634.5	1009.5	2085	2390	2525	2640
Rock	516	524.8	734	1030	1375	2390	2390
Soil	1320	1928	2225	2360	2510	2584	2640

Site-Twin Peaks, Chemical-Manganese

Oneway Analysis of Result (mg/kg) By Matrix

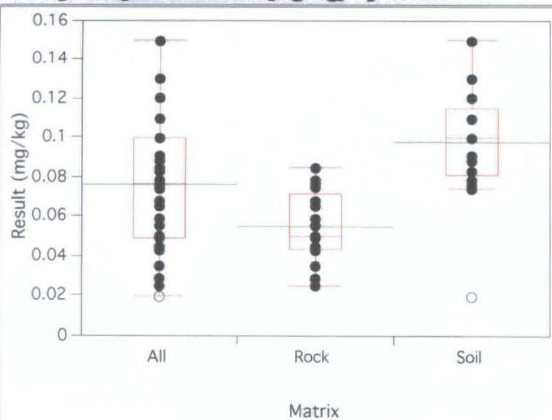


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	366	641	701.75	4317.5	14825	21050	40500
Rock	7800	7944	12400	14500	19550	26900	40500
Soil	366	498	645.5	702	773	819	835

Site-Twin Peaks, Chemical-Mercury

Oneway Analysis of Result (mg/kg) By Matrix

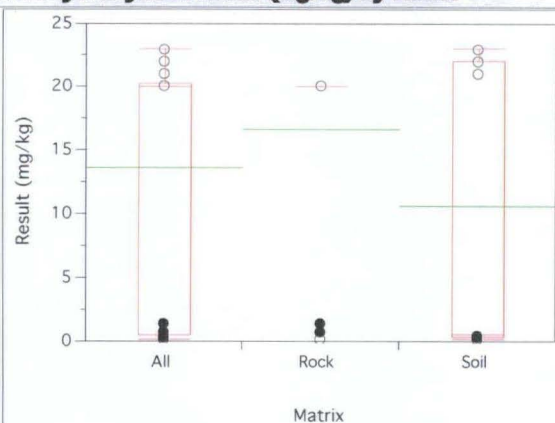


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.02	0.032	0.049	0.0765	0.1	0.12	0.15
Rock	0.025	0.0282	0.0435	0.05	0.0715	0.0802	0.085
Soil	0.02	0.0632	0.081	0.1	0.115	0.134	0.15

Site-Twin Peaks, Chemical-Molybdenum

Oneway Analysis of Result (mg/kg) By Matrix

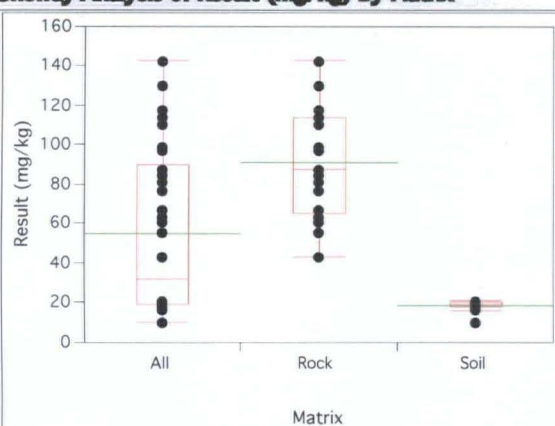


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.16	0.245	0.5	20	20.25	22	23
Rock	0.19	0.654	20	20	20	20	20
Soil	0.16	0.2	0.35	0.54	22	23	23

Site-Twin Peaks, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Matrix

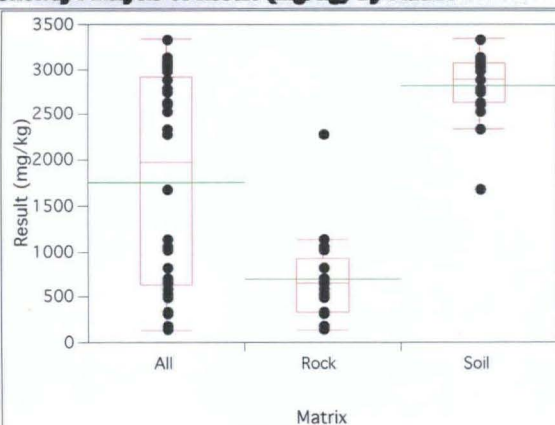


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	10.2	17.45	19.2	32.1	90.075	116	143
Rock	43	53.32	65.35	87.6	114	132.6	143
Soil	10.2	14.84	18	19.2	20.35	20.96	21.2

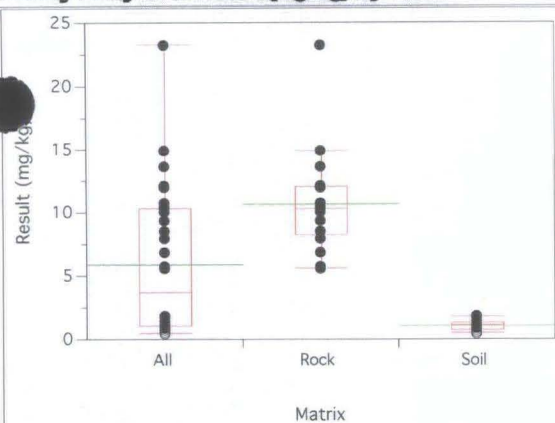
Site-Twin Peaks, Chemical-Potassium

Oneway Analysis of Result (mg/kg) By Matrix

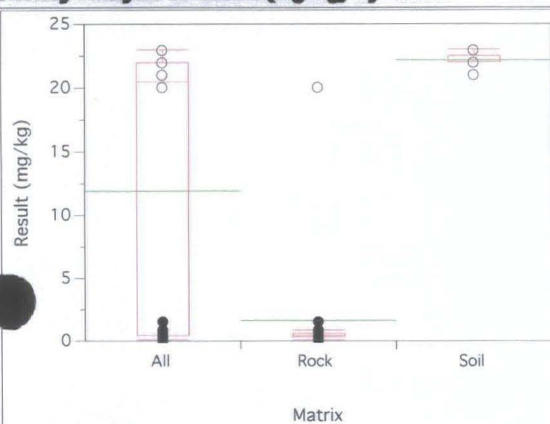


Quantiles

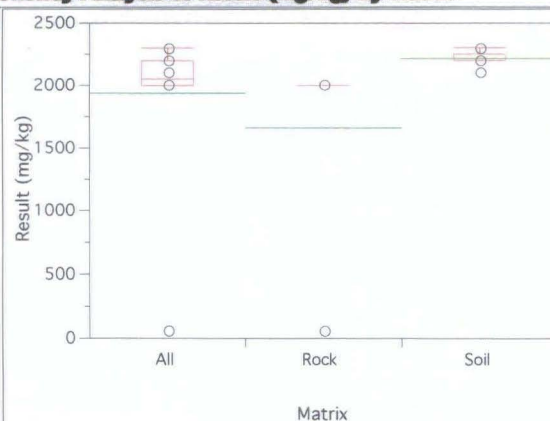
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	135	251	632.75	1980	2915	3085	3340
Rock	135	169.4	331.5	647	921.5	1362	2290
Soil	1670	2206	2630	2890	3070	3172	3340

Site-Twin Peaks, Chemical-Selenium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.51	0.655	1.075	3.7	10.325	12.9	23.3
Rock	5.6	5.76	8.25	10.3	12.05	16.58	23.3
Soil	0.51	0.542	0.745	1.1	1.3	1.72	1.8

Site-Twin Peaks, Chemical-Silver**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

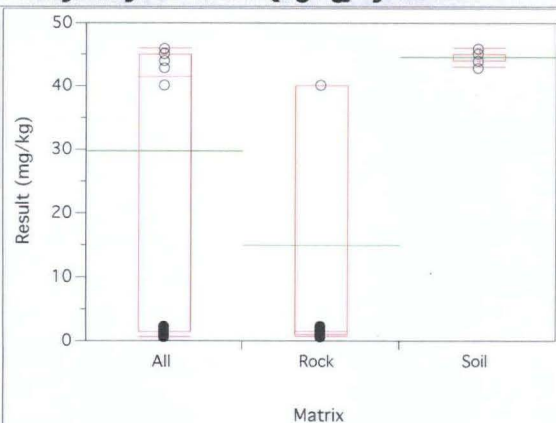
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.088	0.26	0.4375	20.5	22	23	23
Rock	0.088	0.1216	0.335	0.44	0.615	5.28	20
Soil	21	21.8	22	22	22.5	23	23

Site-Twin Peaks, Chemical-Sodium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	64.1	1032.95	2000	2050	2200	2300	2300
Rock	64.1	64.34	2000	2000	2000	2000	2000
Soil	2100	2180	2200	2200	2250	2300	2300

Site-Twin Peaks, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Matrix

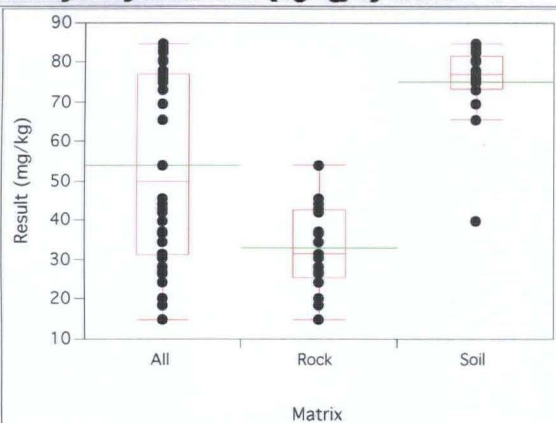


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.67	0.955	1.475	41.5	45	45	46
Rock	0.67	0.71	1.03	1.5	40	40	40
Soil	43	43	44	45	45	46	46

Site-Twin Peaks, Chemical-Vanadium

Oneway Analysis of Result (mg/kg) By Matrix

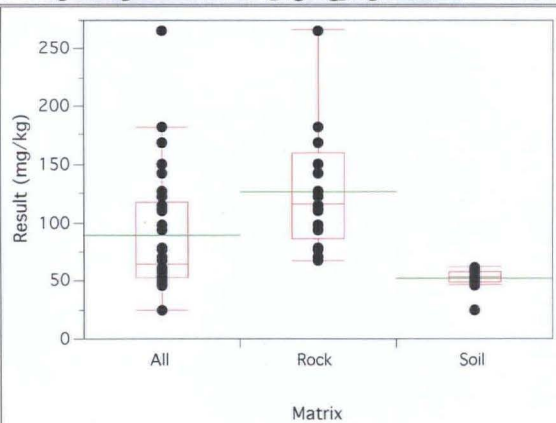


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	14.9	22.4	31.3	50	77.175	82.9	84.8
Rock	14.9	17.7	25.45	31.5	42.75	47.48	54.2
Soil	40.1	60.58	73.35	77.1	81.7	84	84.8

Site-Twin Peaks, Chemical-Zinc

Oneway Analysis of Result (mg/kg) By Matrix

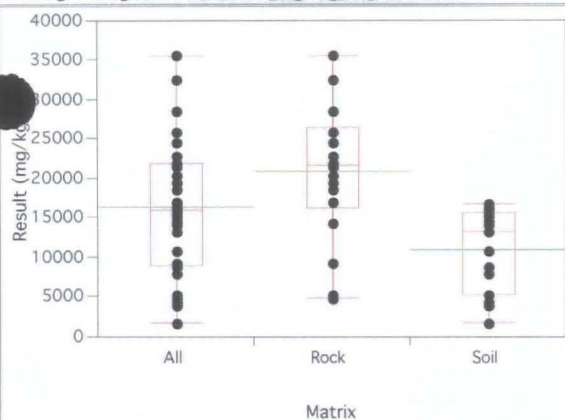


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	24.9	48	52.875	64.4	117.75	169	267
Rock	67	69.88	86.35	116	159.5	199	267
Soil	24.9	42.1	48.95	53	57.55	60.12	61.8

Site-Malta & O'Shaughnessy, Chemical-Aluminum

Oneway Analysis of Result (mg/kg) By Matrix

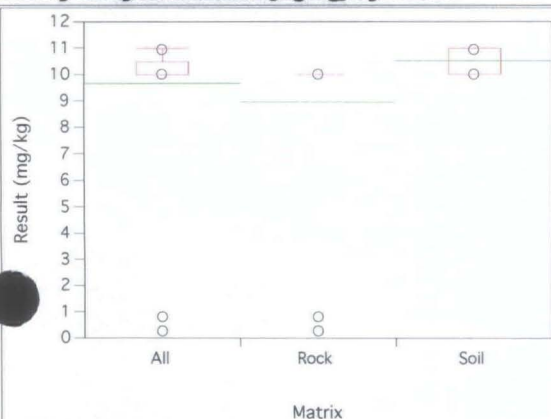


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	1740	4460	9035	16000	21900	30940	35600
Rock	4850	5111	16275	21650	26500	32900	35600
Soil	1740	2964	5260	13300	15700	16500	16800

Site-Malta & O'Shaughnessy, Chemical-Antimony

Oneway Analysis of Result (mg/kg) By Matrix

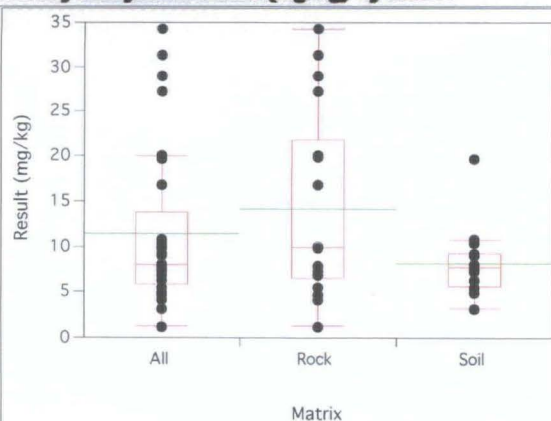


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.31	10	10	10	10.5	11	11
Rock	0.31	0.787	10	10	10	10	10
Soil	10	10	10	11	11	11	11

Site-Malta & O'Shaughnessy, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Matrix

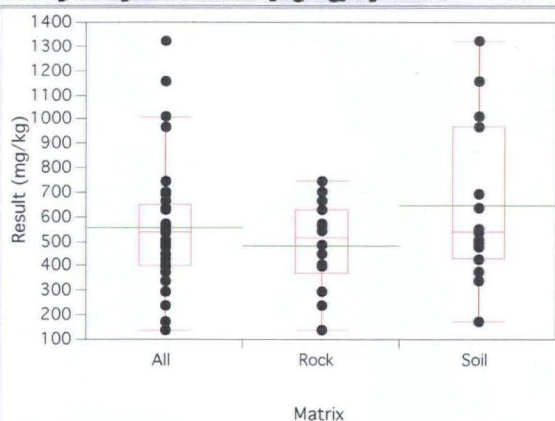


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	1.3	3.56	5.9	8	13.75	28.34	34.2
Rock	1.3	3.82	6.5	9.85	21.8	31.68	34.2
Soil	3.2	3.2	5.6	7.7	9.2	14.3	19.7

Site-Malta & O'Shaughnessy, Chemical-Barium

Oneway Analysis of Result (mg/kg) By Matrix

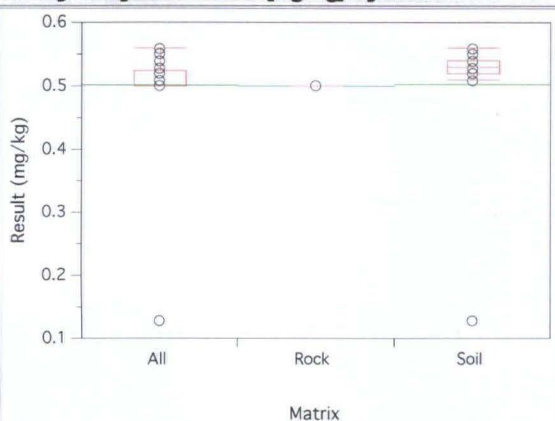


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	139	238.4	401.5	539	650.5	994	1320
Rock	139	228.1	371	515	629.25	709.2	747
Soil	173	273.8	430	539	970	1224	1320

Site-Malta & O'Shaughnessy, Chemical-Beryllium

Oneway Analysis of Result (mg/kg) By Matrix

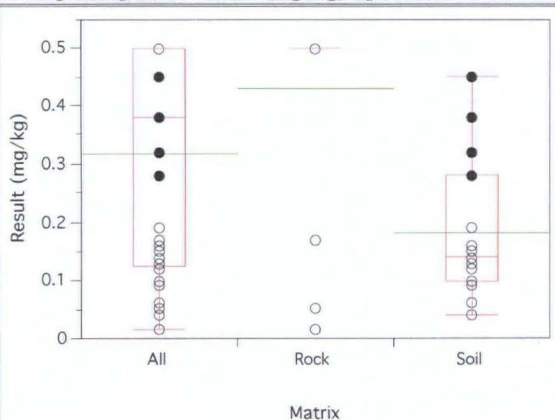


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.13	0.5	0.5	0.5	0.525	0.54	0.56
Rock	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Soil	0.13	0.358	0.52	0.53	0.54	0.554	0.56

Site-Malta & O'Shaughnessy, Chemical-Cadmium

Oneway Analysis of Result (mg/kg) By Matrix

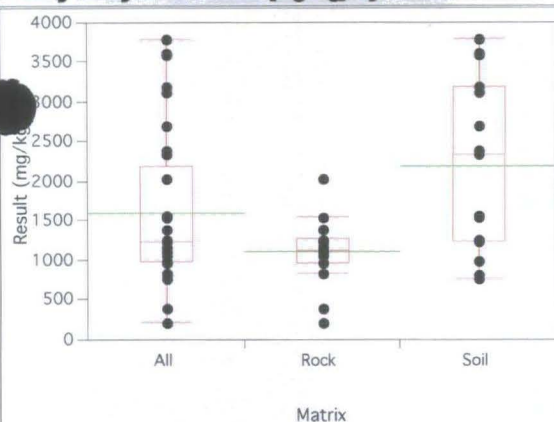


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.016	0.056	0.125	0.38	0.5	0.5	0.5
Rock	0.016	0.0484	0.5	0.5	0.5	0.5	0.5
Soil	0.04	0.0532	0.098	0.14	0.28	0.408	0.45

Site-Malta & O'Shaughnessy, Chemical-Calcium

Oneway Analysis of Result (mg/kg) By Matrix

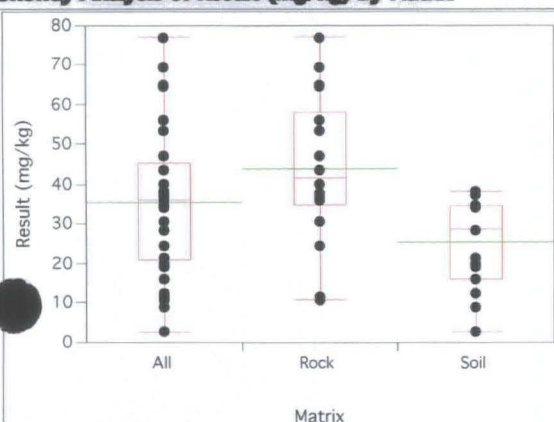


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	221	781.2	986.5	1240	2190	3424	3790
Rock	221	374	964.75	1125	1282.5	1599	2040
Soil	766	788.8	1240	2340	3190	3682	3790

Site-Malta & O'Shaughnessy, Chemical-Chromium

Oneway Analysis of Result (mg/kg) By Matrix

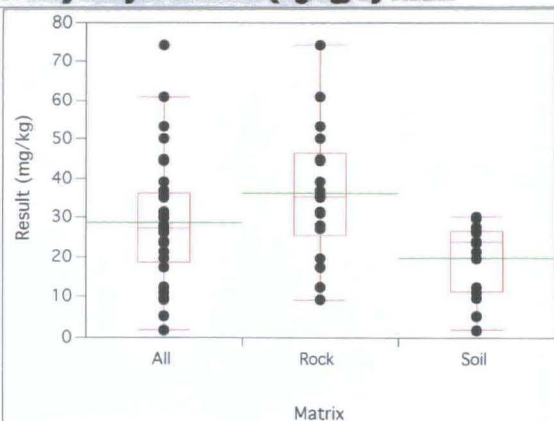


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2.7	11.18	21	36.3	45.4	64.82	77.1
Rock	10.9	11.53	34.925	41.75	58.1	70.35	77.1
Soil	2.7	6.48	16.1	28.8	34.7	38.24	38.3

Site-Malta & O'Shaughnessy, Chemical-Cobalt

Oneway Analysis of Result (mg/kg) By Matrix

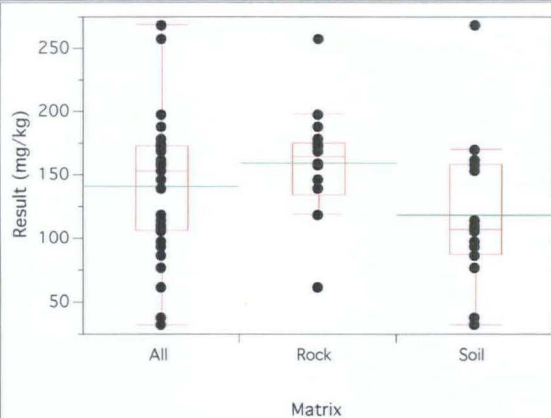


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	1.9	9.5	18.65	27.4	36.35	52.16	74.4
Rock	9.3	12.27	25.475	35.4	46.475	62.25	74.4
Soil	1.9	4.06	11.4	23.9	26.7	30.12	30.3

Site-Malta & O'Shaughnessy, Chemical-Copper

Oneway Analysis of Result (mg/kg) By Matrix

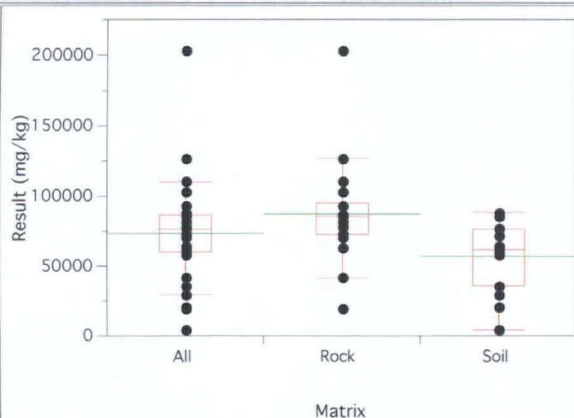


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	32.2	67.96	106.5	153	173	194	269
Rock	61.8	113.28	134	164	175	203.9	257
Soil	32.2	36.04	87.4	107	158	209.6	269

Site-Malta & O'Shaughnessy, Chemical-Iron

Oneway Analysis of Result (mg/kg) By Matrix

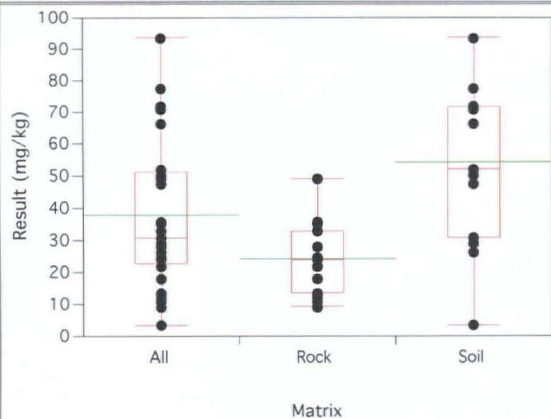


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	4340	23860	60350	76400	86650	107200	203000
Rock	19100	39080	72625	85600	95125	134600	203000
Soil	4340	13796	35700	61800	76400	86460	88500

Site-Malta & O'Shaughnessy, Chemical-Lead

Oneway Analysis of Result (mg/kg) By Matrix

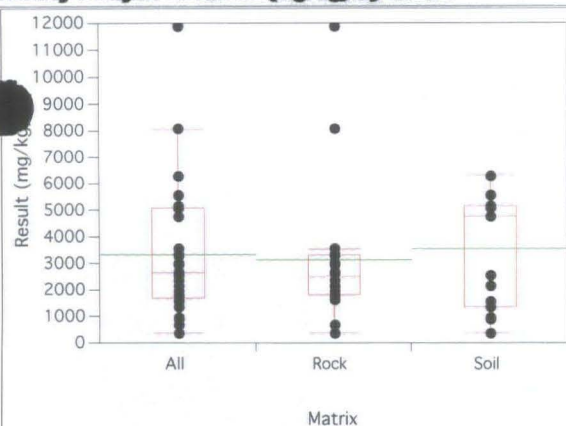


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	3.3	11.22	22.75	30.8	51.2	71.78	93.7
Rock	9.3	10.74	13.575	24.05	32.85	37.13	49.1
Soil	3.3	17.04	30.8	52	71.6	84.04	93.7

Site-Malta & O'Shaughnessy, Chemical-Magnesium

Oneway Analysis of Result (mg/kg) By Matrix

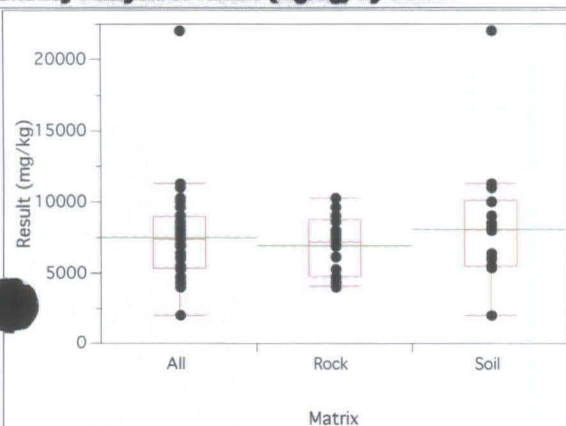


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	385	778.2	1695	2650	5085	6306	11900
Rock	388	649.9	1805	2505	3312.5	8444	11900
Soil	385	710.2	1360	4760	5150	6304	6310

Site-Malta & O'Shaughnessy, Chemical-Manganese

Oneway Analysis of Result (mg/kg) By Matrix

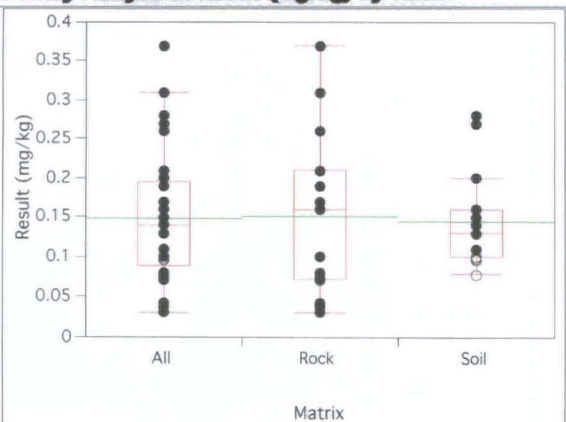


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2000	4204	5365	7400	9015	10780	22100
Rock	4120	4309	4807.5	7200	8785	9688	10300
Soil	2000	2006	5530	8070	10100	15620	22100

Site-Malta & O'Shaughnessy, Chemical-Mercury

Oneway Analysis of Result (mg/kg) By Matrix

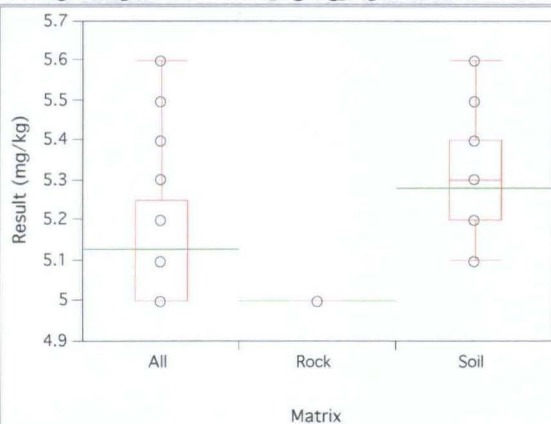


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.031	0.0542	0.089	0.14	0.195	0.276	0.37
Rock	0.031	0.0373	0.0725	0.16	0.21	0.316	0.37
Soil	0.079	0.0898	0.1	0.13	0.16	0.274	0.28

Site-Malta & O'Shaughnessy, Chemical-Molybdenum

Oneway Analysis of Result (mg/kg) By Matrix

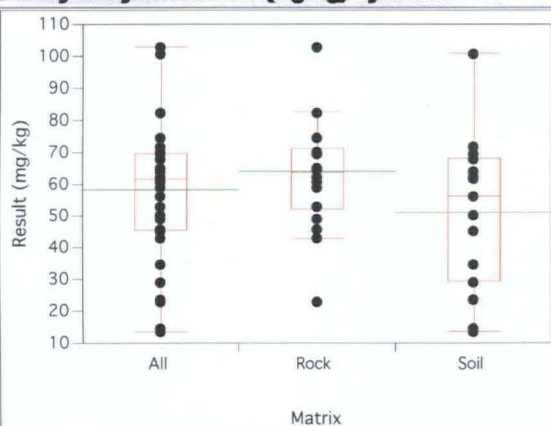


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	5	5	5	5	5.25	5.4	5.6
Rock	5	5	5	5	5	5	5
Soil	5.1	5.1	5.2	5.3	5.4	5.54	5.6

Site-Malta & O'Shaughnessy, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Matrix

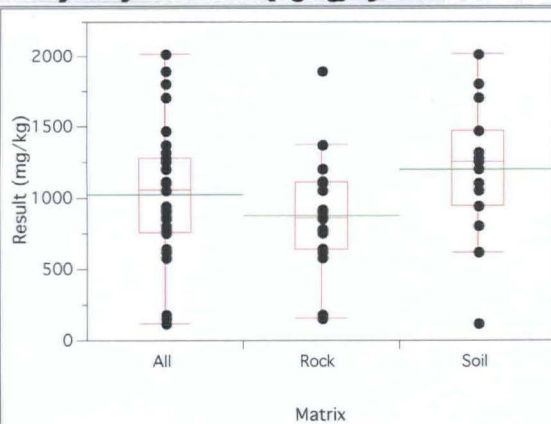


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	13.6	23.4	45.5	61.8	69.75	93.68	103
Rock	23.2	40.84	52.075	63.75	71.325	103	103
Soil	13.6	14.2	29.4	56.3	68.2	83.42	101

Site-Malta & O'Shaughnessy, Chemical-Potassium

Oneway Analysis of Result (mg/kg) By Matrix

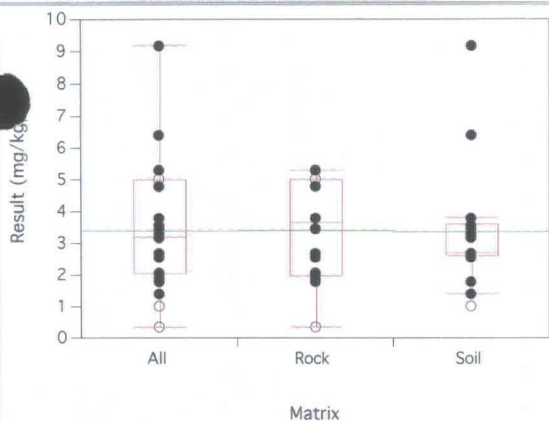


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	119	338.6	759.5	1060	1280	1770	2020
Rock	156	178.5	640	860.5	1112.5	1422	1890
Soil	119	416.6	944	1250	1470	1894	2020

Site-Malta & O'Shaughnessy, Chemical-Selenium

Oneway Analysis of Result (mg/kg) By Matrix

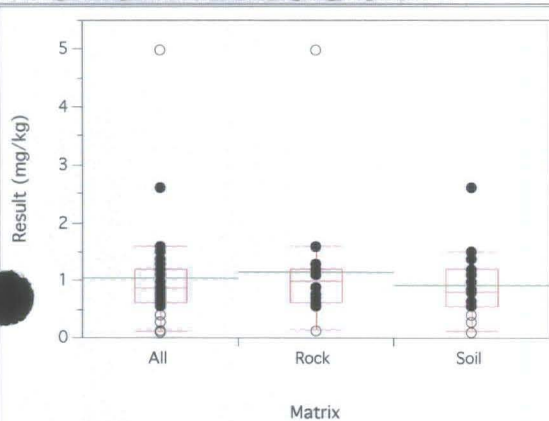


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.35	1.16	2.05	3.2	5	5.18	9.2
Rock	0.35	0.359	1.975	3.65	5	5.03	5.3
Soil	1	1.24	2.6	2.7	3.6	7.52	9.2

Site-Malta & O'Shaughnessy, Chemical-Silver

Oneway Analysis of Result (mg/kg) By Matrix

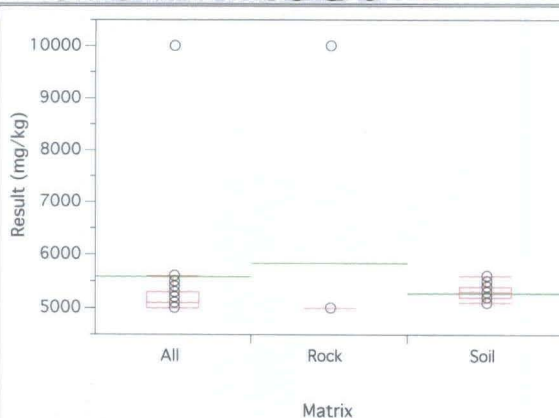


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.12	0.338	0.62	0.88	1.2	1.56	5
Rock	0.15	0.51	0.625	1	1.2	1.94	5
Soil	0.12	0.222	0.55	0.81	1.2	1.94	2.6

Site-Malta & O'Shaughnessy, Chemical-Sodium

Oneway Analysis of Result (mg/kg) By Matrix

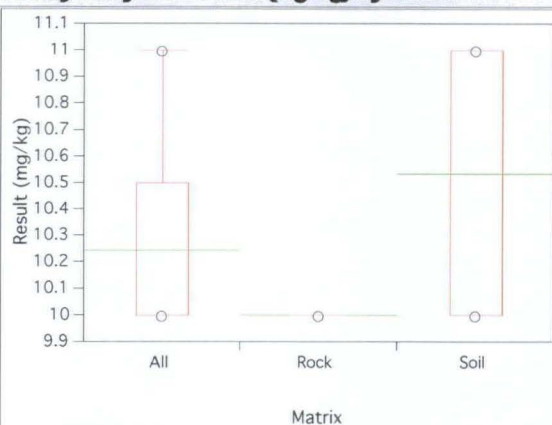


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	5000	5000	5000	5100	5300	8240	10000
Rock	5000	5000	5000	5000	5000	10000	10000
Soil	5100	5100	5200	5300	5400	5540	5600

Site-Malta & O'Shaughnessy, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Matrix

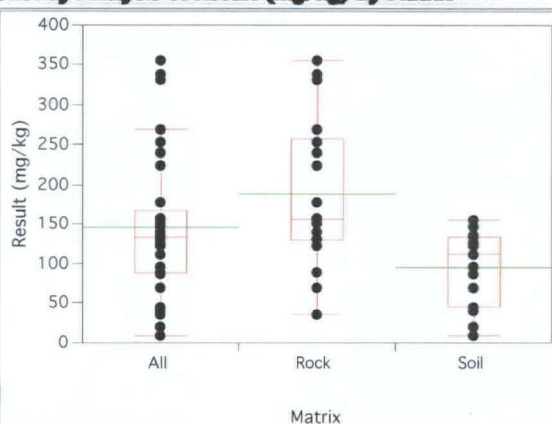


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	10	10	10	10	10.5	11	11
Rock	10	10	10	10	10	10	10
Soil	10	10	10	11	11	11	11

Site-Malta & O'Shaughnessy, Chemical-Vanadium

Oneway Analysis of Result (mg/kg) By Matrix

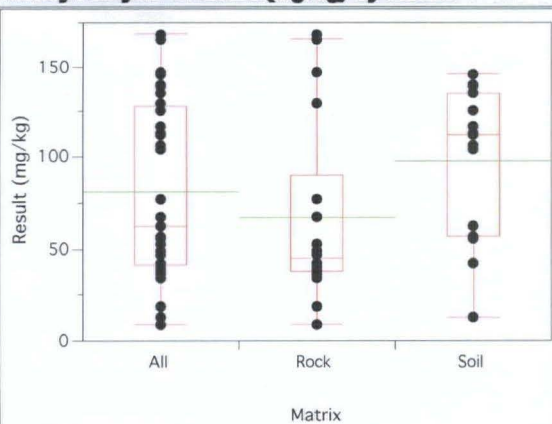


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	9	37.78	88.65	134	168	307.2	356
Rock	36.3	66.81	130.25	157	258	340.7	356
Soil	9	15.66	45.6	112	134	151.2	156

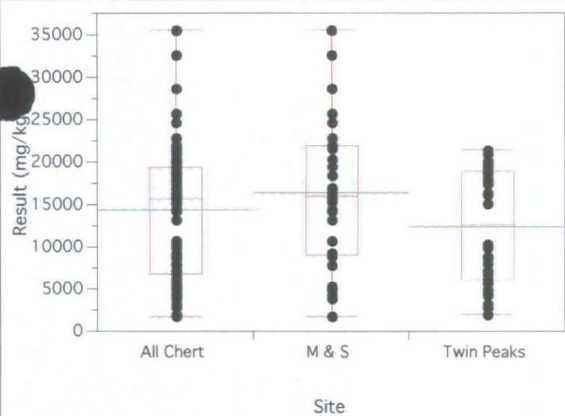
Site-Malta & O'Shaughnessy, Chemical-Zinc

Oneway Analysis of Result (mg/kg) By Matrix

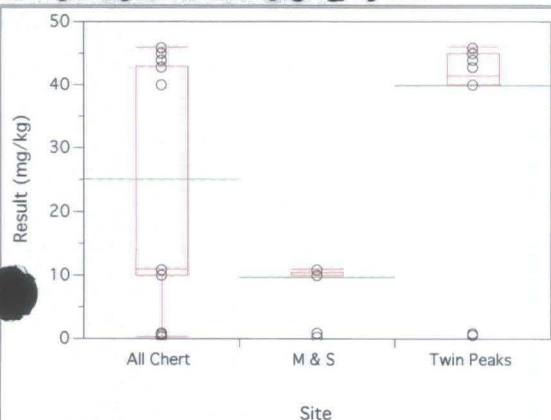


Quantiles

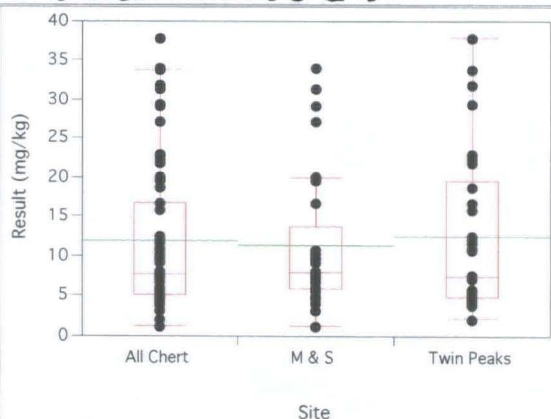
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	9	25.26	41.25	62.3	128	146.6	169
Rock	9	17.91	37.5	44.85	90.025	166.3	169
Soil	12.5	30.38	56.8	112	135	142.4	146

Matrix-All, Chemical-Aluminum**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

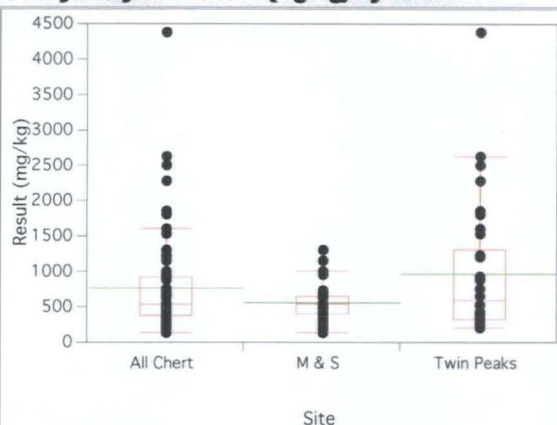
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	1740	4264	6780	15700	19400	23080	35600
M & S	1740	4460	9035	16000	21900	30940	35600
Twin Peaks	2010	3745	6105	12600	18925	20100	21400

Matrix-All, Chemical-Antimony**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

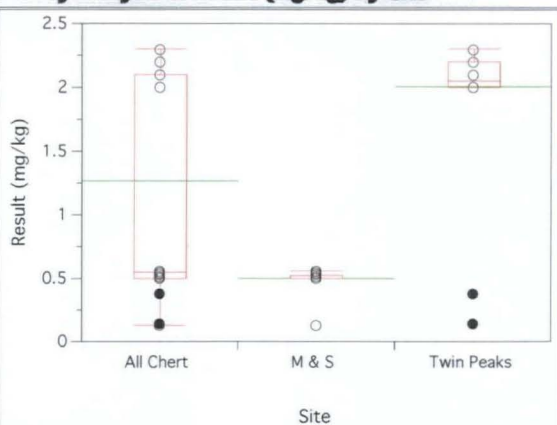
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.31	10	10	11	43	45	46
M & S	0.31	10	10	10	10.5	11	11
Twin Peaks	0.62	40	40	41.5	45	45	46

Matrix-All, Chemical-Arsenic**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

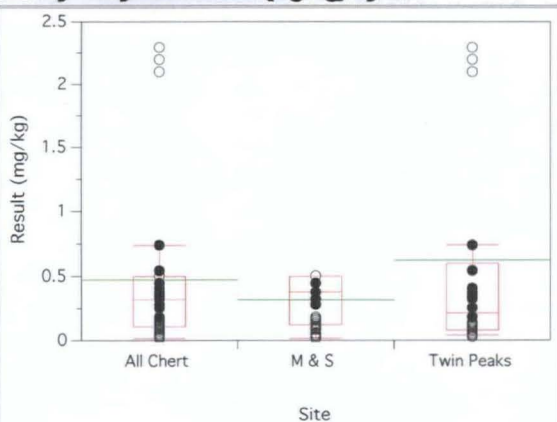
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	1.3	4.08	5.2	7.8	16.8	29.16	37.9
M & S	1.3	3.56	5.9	8	13.75	28.34	34.2
Twin Peaks	2.2	4.2	4.9	7.45	19.575	30.6	37.9

Matrix-All, Chemical-Barium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

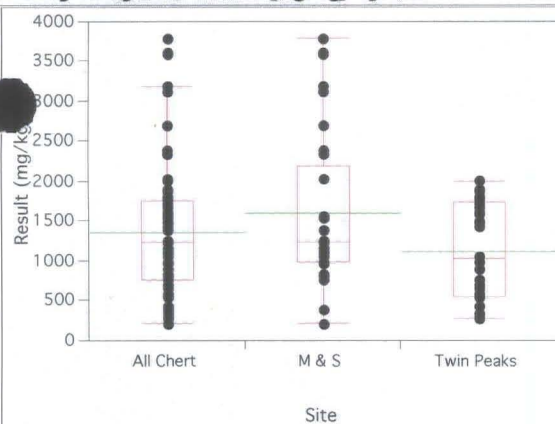
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	139	238.8	380	539	925	1650	4390
M & S	139	238.4	401.5	539	650.5	994	1320
Twin Peaks	205	243	323.75	596.5	1307.5	2400	4390

Matrix-All, Chemical-Beryllium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

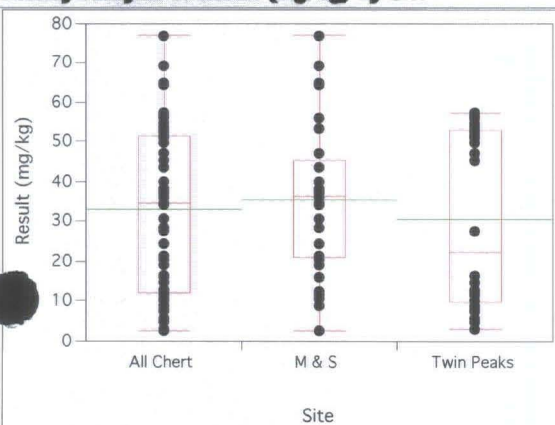
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.13	0.5	0.5	0.55	2.1	2.2	2.3
M & S	0.13	0.5	0.5	0.5	0.525	0.54	0.56
Twin Peaks	0.15	2	2	2.05	2.2	2.3	2.3

Matrix-All, Chemical-Cadmium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

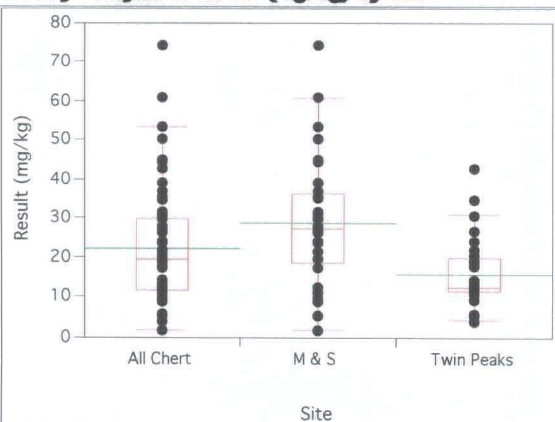
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.016	0.059	0.11	0.32	0.5	2.12	2.3
M & S	0.016	0.056	0.125	0.38	0.5	0.5	0.5
Twin Peaks	0.039	0.0575	0.0795	0.215	0.5975	2.2	2.3

Matrix-All, Chemical-Calcium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

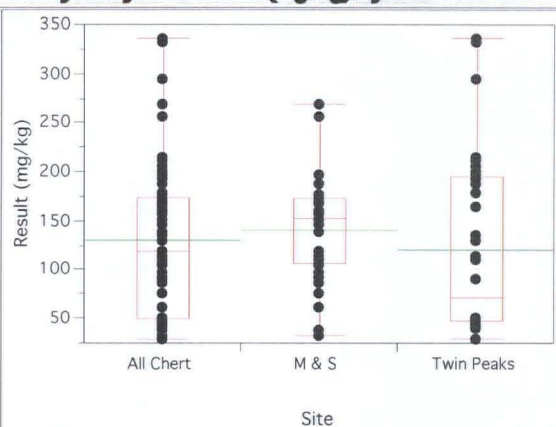
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	221	381.6	765	1240	1760	2450	3790
M & S	221	781.2	986.5	1240	2190	3424	3790
Twin Peaks	279	316	552.5	1030	1737.5	1845	2000

Matrix-All, Chemical-Chromium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

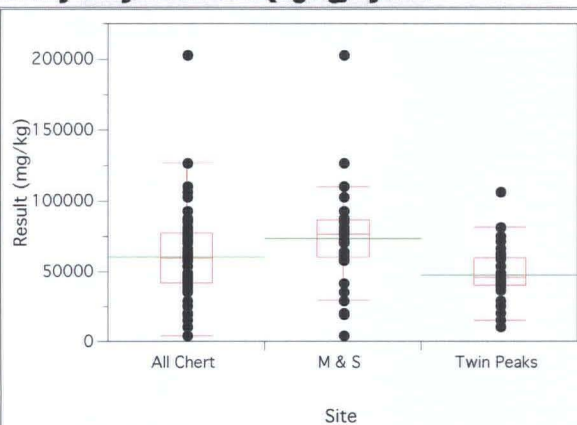
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	2.7	7.96	12.2	34.7	51.5	57.04	77.1
M & S	2.7	11.18	21	36.3	45.4	64.82	77.1
Twin Peaks	3.1	6.85	9.95	22.25	52.925	56.75	57.3

Matrix-All, Chemical-Cobalt**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

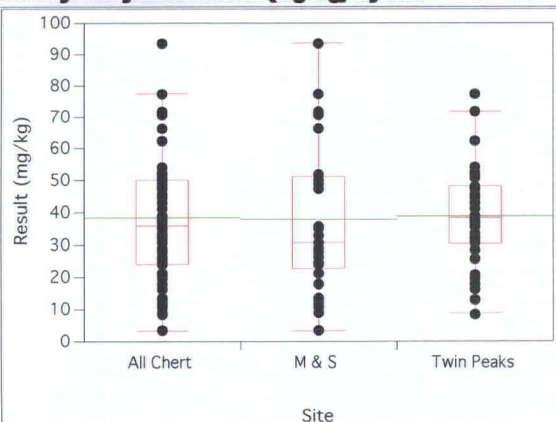
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	1.9	9.46	11.7	19.5	30	43.06	74.4
M & S	1.9	9.5	18.65	27.4	36.35	52.16	74.4
Twin Peaks	4.4	7.85	11.5	12.45	19.8	28.95	42.7

Matrix-AI, Chemical-Copper
Oneway Analysis of Result (mg/kg) By Site

Quantiles

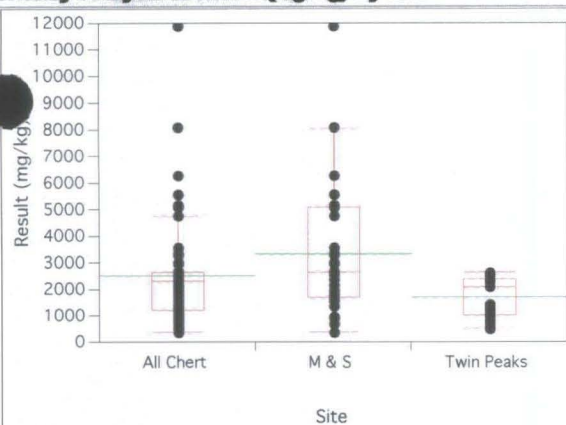
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	29.1	45.12	49.5	119	174	212.6	336
M & S	32.2	67.96	106.5	153	173	194	269
Twin Peaks	29.1	43.55	47.125	70.8	194.75	255	336

Matrix-AI, Chemical-Iron
Oneway Analysis of Result (mg/kg) By Site

Quantiles

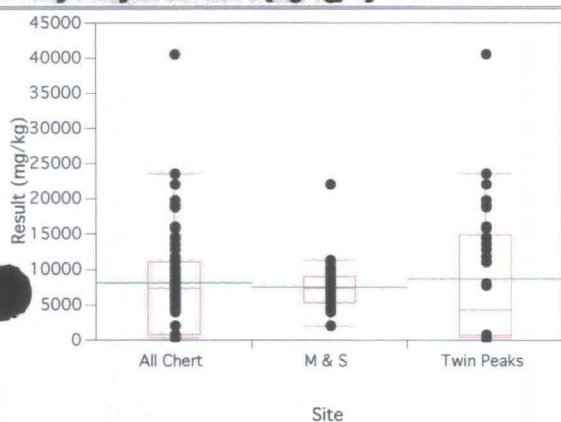
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	4340	20580	42100	59600	77600	89300	203000
M & S	4340	23860	60350	76400	86650	107200	203000
Twin Peaks	10200	17900	40075	45800	59650	73100	107000

Matrix-AI, Chemical-Lead
Oneway Analysis of Result (mg/kg) By Site

Quantiles

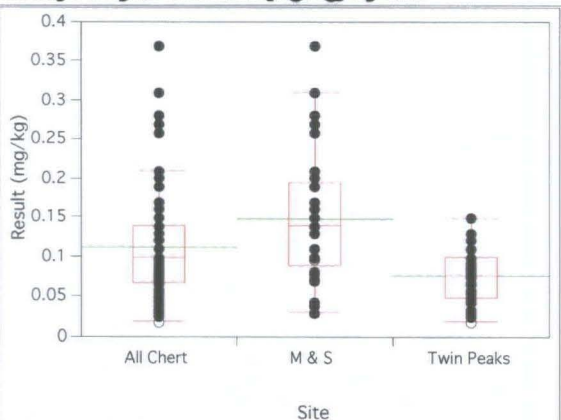
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	3.3	12.88	24.1	36	50.2	71.36	93.7
M & S	3.3	11.22	22.75	30.8	51.2	71.78	93.7
Twin Peaks	8.8	17.15	30.35	38.4	48.125	58.2	77.3

Matrix-All, Chemical-Magnesium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

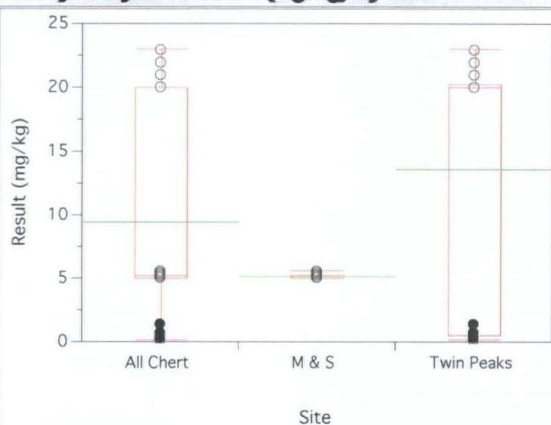
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	385	708.6	1210	2320	2650	5102	11900
M & S	385	778.2	1695	2650	5085	6306	11900
Twin Peaks	516	634.5	1009.5	2085	2390	2525	2640

Matrix-All, Chemical-Manganese**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

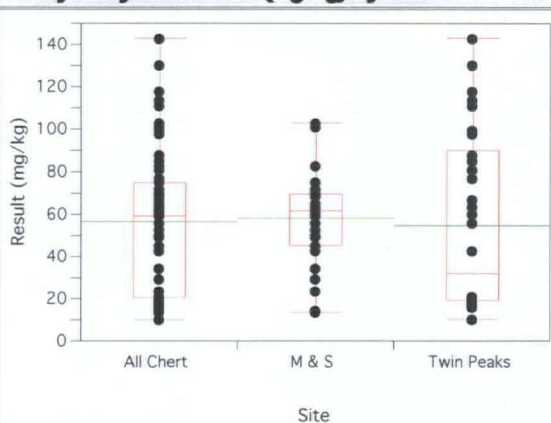
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	366	699.2	835	7400	11100	18800	40500
M & S	2000	4204	5365	7400	9015	10780	22100
Twin Peaks	366	641	701.75	4317.5	14825	21050	40500

Matrix-All, Chemical-Mercury**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

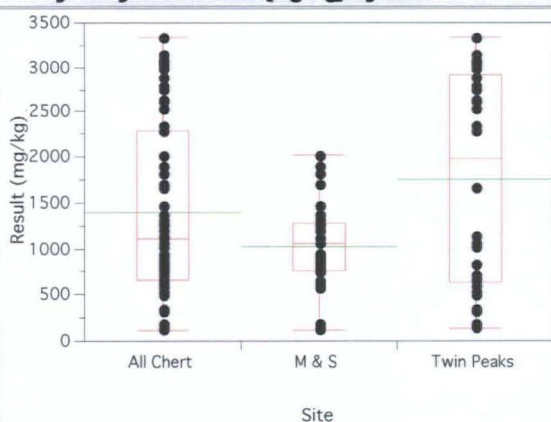
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.02	0.042	0.068	0.099	0.14	0.21	0.37
M & S	0.031	0.0542	0.089	0.14	0.195	0.276	0.37
Twin Peaks	0.02	0.032	0.049	0.0765	0.1	0.12	0.15

Matrix-All, Chemical-Molybdenum**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

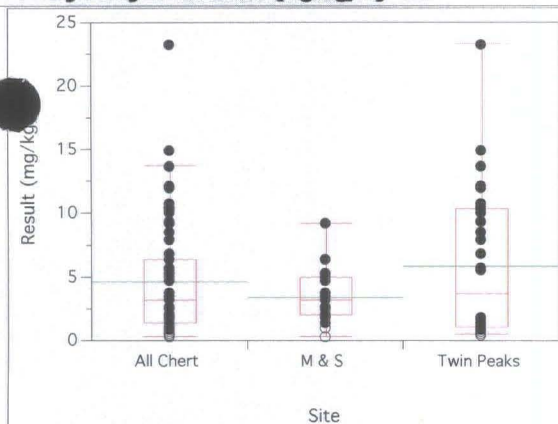
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.16	0.392	5	5.2	20	22	23
M & S	5	5	5	5	5.25	5.4	5.6
Twin Peaks	0.16	0.245	0.5	20	20.25	22	23

Matrix-All, Chemical-Nickel**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

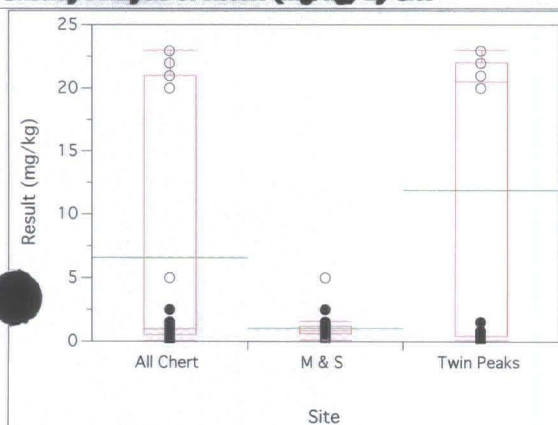
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	10.2	18.06	20.6	59.4	75	104.6	143
M & S	13.6	23.4	45.5	61.8	69.75	93.68	103
Twin Peaks	10.2	17.45	19.2	32.1	90.075	116	143

Matrix-All, Chemical-Potassium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

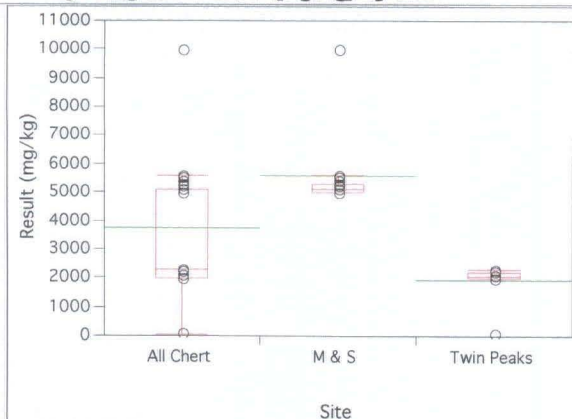
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	119	294.6	663	1110	2290	3032	3340
M & S	119	338.6	759.5	1060	1280	1770	2020
Twin Peaks	135	251	632.75	1980	2915	3085	3340

Matrix-All, Chemical-Selenium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

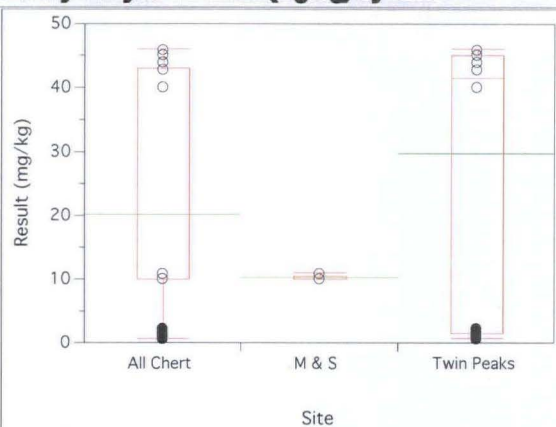
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.35	0.772	1.4	3.2	6.4	10.54	23.3
M & S	0.35	1.16	2.05	3.2	5	5.18	9.2
Twin Peaks	0.51	0.655	1.075	3.7	10.325	12.9	23.3

Matrix-All, Chemical-Silver**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

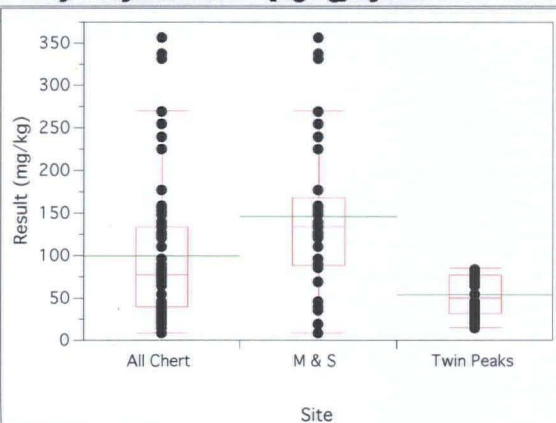
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.088	0.288	0.52	1	21	22	23
M & S	0.12	0.338	0.62	0.88	1.2	1.56	5
Twin Peaks	0.088	0.26	0.4375	20.5	22	23	23

Matrix-All, Chemical-Sodium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

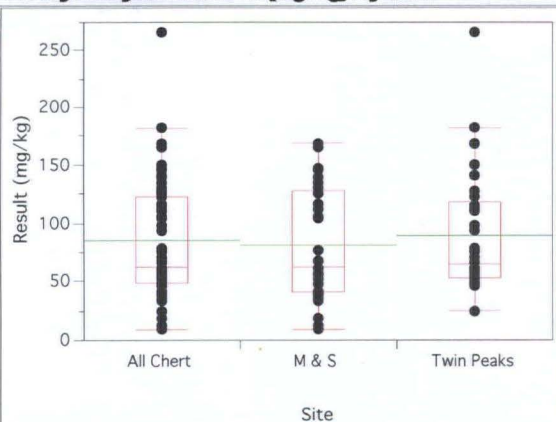
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	64.1	2000	2000	2300	5100	5400	10000
M & S	5000	5000	5000	5100	5300	8240	10000
Twin Peaks	64.1	1032.95	2000	2050	2200	2300	2300

Matrix-All, Chemical-Thallium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	0.67	1.38	10	10	43	45	46
M & S	10	10	10	10	10.5	11	11
Twin Peaks	0.67	0.955	1.475	41.5	45	45	46

Matrix-All, Chemical-Vanadium**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	9	26.14	40.1	77.4	134	228.2	356
M & S	9	37.78	88.65	134	168	307.2	356
Twin Peaks	14.9	22.4	31.3	50	77.175	82.9	84.8

Matrix-All, Chemical-Zinc**Oneway Analysis of Result (mg/kg) By Site****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All Chert	9	37.6	48.6	62.3	123	153.2	267
M & S	9	25.26	41.25	62.3	128	146.6	169
Twin Peaks	24.9	48	52.875	64.4	117.75	169	267

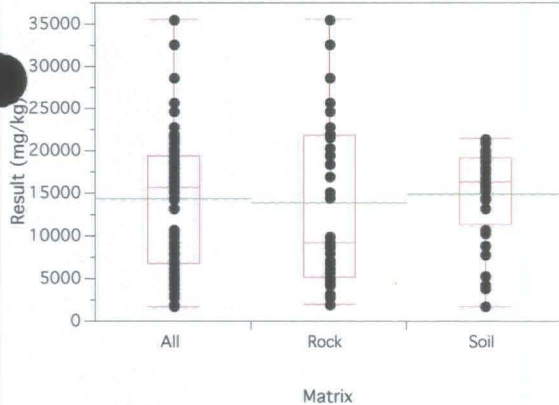
Chert Sites - All Metals

By site, separately and combined

By matrix, separately and combined

Rock Type-Chert, Chemical-Aluminum

Oneway Analysis of Result (mg/kg) By Matrix

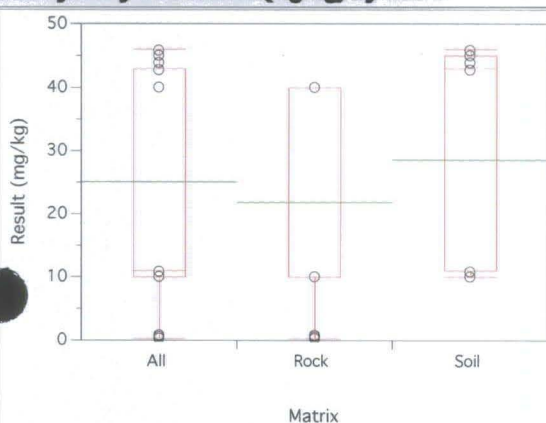


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	1740	4264	6780	15700	19400	23080	35600
Rock	2010	3852	5140	9190	21800	30160	35600
Soil	1740	4518	11350	16300	19175	20100	21400

Rock Type-Chert, Chemical-Antimony

Oneway Analysis of Result (mg/kg) By Matrix

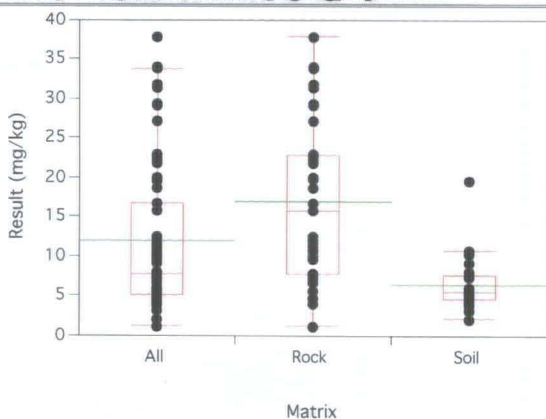


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.31	10	10	11	43	45	46
Rock	0.31	0.858	10	10	40	40	40
Soil	10	10	11	43	45	45	46

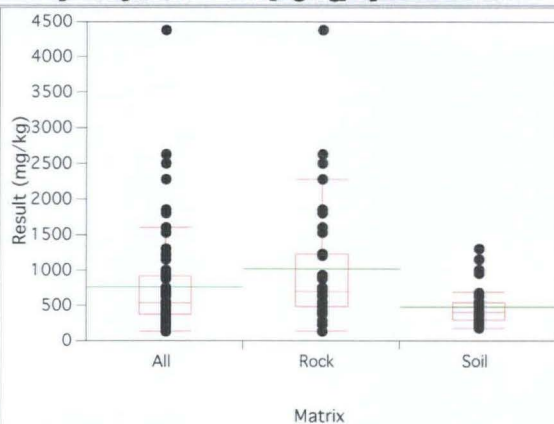
Rock Type-Chert, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Matrix

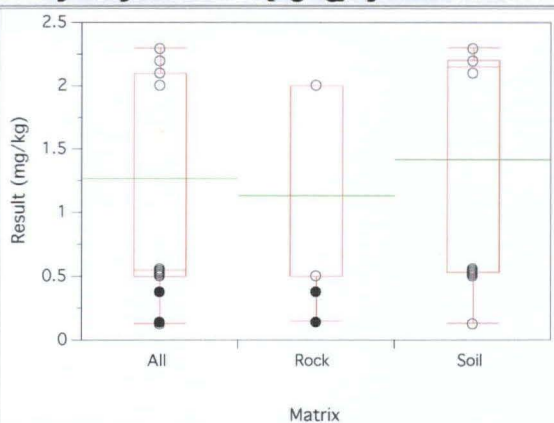


Quantiles

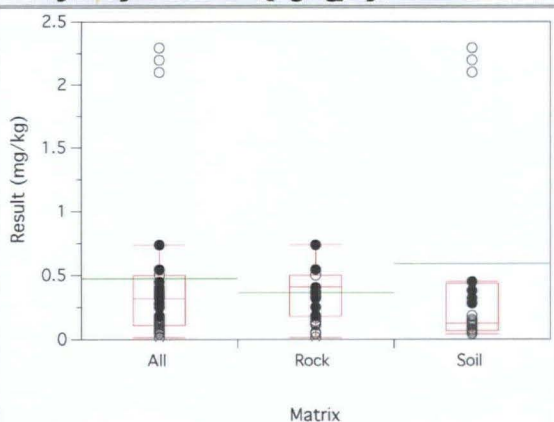
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	1.3	4.08	5.2	7.8	16.8	29.16	37.9
Rock	1.3	5.28	7.8	15.8	22.9	32.6	37.9
Soil	2.2	3.38	4.65	5.55	7.65	10.04	19.7

Rock Type-Chert, Chemical-Barium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

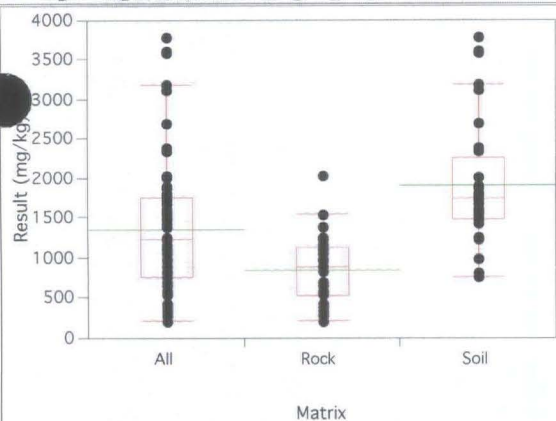
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	139	238.8	380	539	925	1650	4390
Rock	139	273.2	487	705	1230	2376	4390
Soil	173	233.3	296	404	538	998	1320

Rock Type-Chert, Chemical-Beryllium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

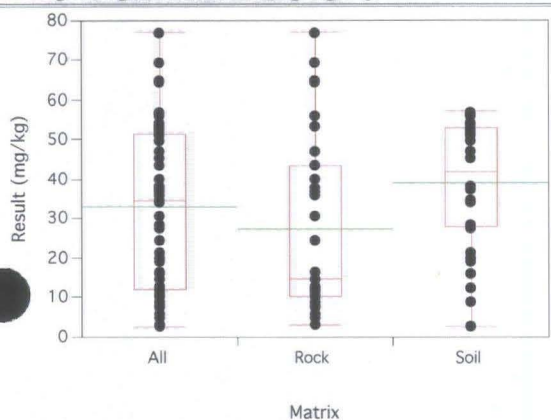
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.13	0.5	0.5	0.55	2.1	2.2	2.3
Rock	0.15	0.5	0.5	0.5	2	2	2
Soil	0.13	0.513	0.53	2.15	2.2	2.3	2.3

Rock Type-Chert, Chemical-Cadmium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

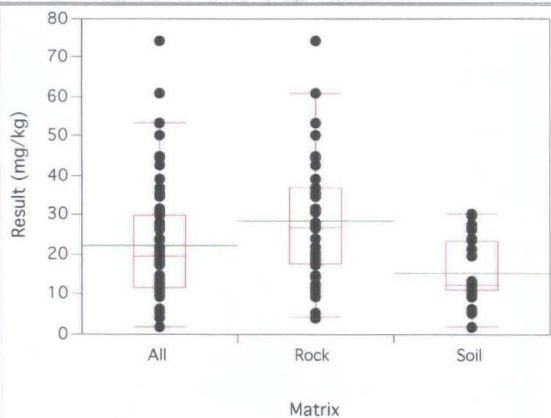
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.016	0.059	0.11	0.32	0.5	2.12	2.3
Rock	0.016	0.092	0.18	0.41	0.5	0.5	0.74
Soil	0.039	0.0508	0.06675	0.125	0.4325	2.2	2.3

Rock Type-Chart, Chemical-Calcium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	221	381.6	765	1240	1760	2450	3790
Rock	221	297.6	531	889	1130	1388	2040
Soil	765	862.8	1485	1745	2255	3463	3790

Rock Type-Chart, Chemical-Chromium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

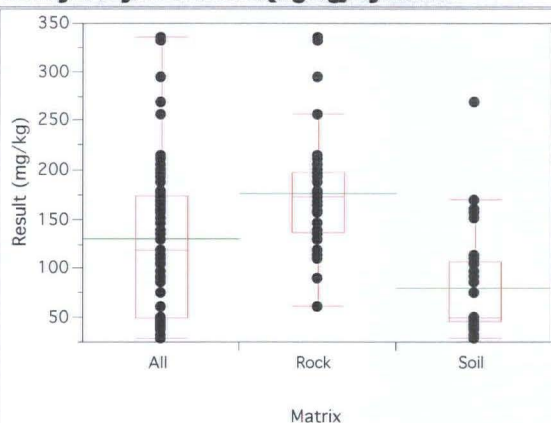
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2.7	7.96	12.2	34.7	51.5	57.04	77.1
Rock	3.1	7.02	10.3	14.8	43.5	64.68	77.1
Soil	2.7	13.79	27.975	41.9	52.975	56.85	57.3

Rock Type-Chart, Chemical-Cobalt**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	1.9	9.46	11.7	19.5	30	43.06	74.4
Rock	4.4	10.2	17.7	26.9	37	51.54	74.4
Soil	1.9	7.19	11.25	12.35	23.325	27.47	30.3

Rock Type-Chert, Chemical-Copper

Oneway Analysis of Result (mg/kg) By Matrix

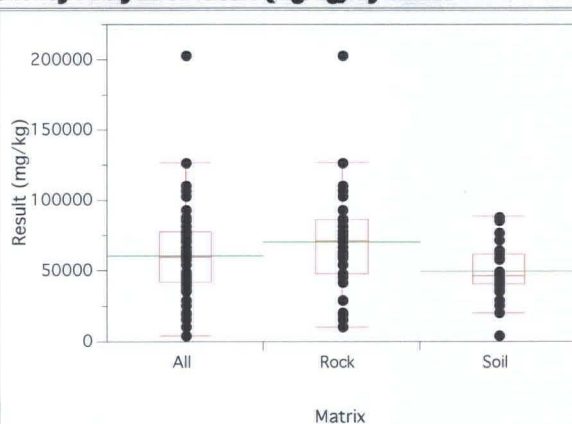


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	29.1	45.12	49.5	119	174	212.6	336
Rock	61.8	113.4	137	173	198	272.2	336
Soil	29.1	39.26	46.025	49.5	106.75	160.8	269

Rock Type-Chert, Chemical-Iron

Oneway Analysis of Result (mg/kg) By Matrix

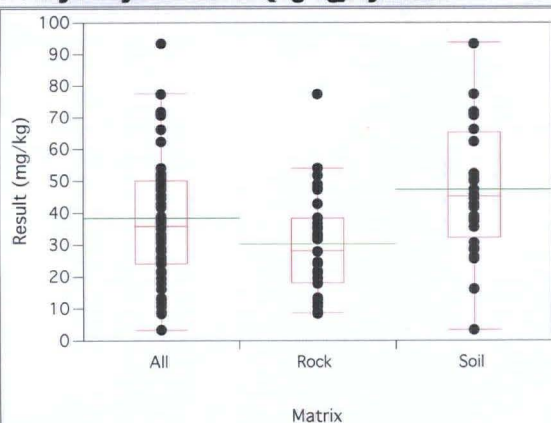


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	4340	20580	42100	59600	77600	89300	203000
Rock	10200	17500	47700	71200	86400	108200	203000
Soil	4340	26280	40525	46100	61625	76890	88500

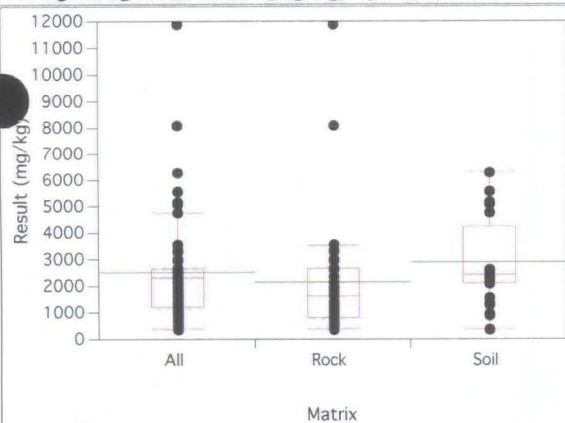
Rock Type-Chert, Chemical-Lead

Oneway Analysis of Result (mg/kg) By Matrix

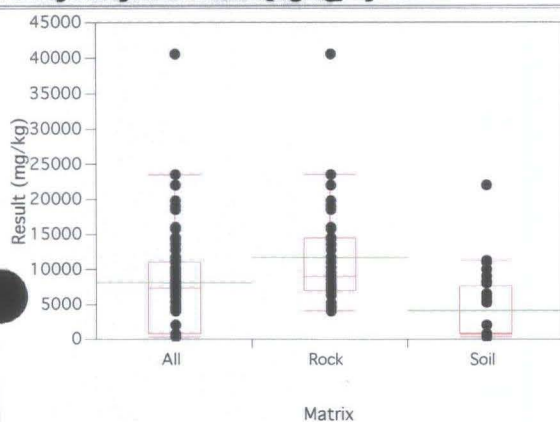


Quantiles

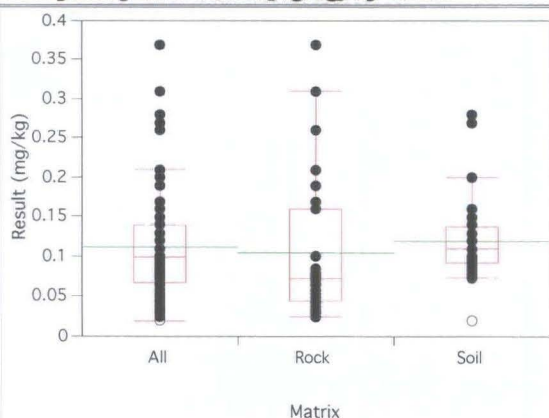
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	3.3	12.88	24.1	36	50.2	71.36	93.7
Rock	8.8	11.38	18.2	28.2	38.4	50.18	77.3
Soil	3.3	25.92	32.25	45.2	65.25	71.87	93.7

Rock Type-Chart, Chemical-Magnesium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	385	708.6	1210	2320	2650	5102	11900
Rock	388	542.6	810	1630	2650	3444	11900
Soil	385	1096	2100	2415	4230	5437	6310

Rock Type-Chart, Chemical-Manganese**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

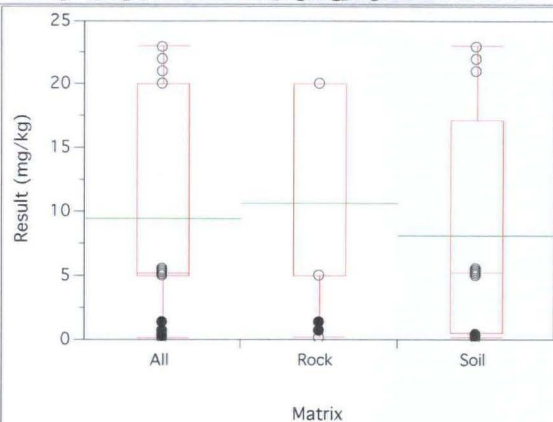
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	366	699.2	835	7400	11100	18800	40500
Rock	4120	4570	7000	9020	14500	20820	40500
Soil	366	640.6	701.25	825	7670	10800	22100

Rock Type-Chart, Chemical-Mercury**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.02	0.042	0.068	0.099	0.14	0.21	0.37
Rock	0.025	0.0334	0.045	0.073	0.16	0.23	0.37
Soil	0.02	0.0769	0.0925	0.11	0.1375	0.188	0.28

Rock Type-Chert, Chemical-Molybdenum

Oneway Analysis of Result (mg/kg) By Matrix

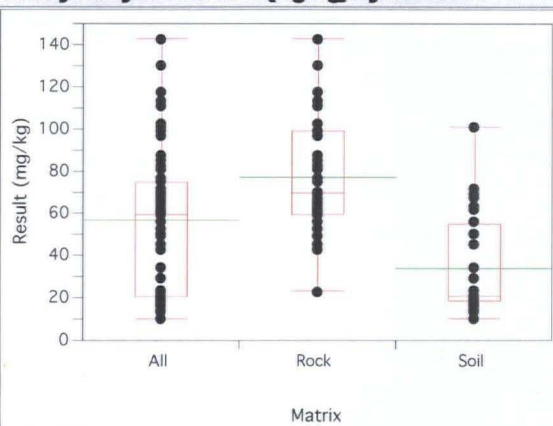


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.16	0.392	5	5.2	20	22	23
Rock	0.19	3.56	5	5	20	20	20
Soil	0.16	0.298	0.51	5.25	17.15	22	23

Rock Type-Chert, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Matrix

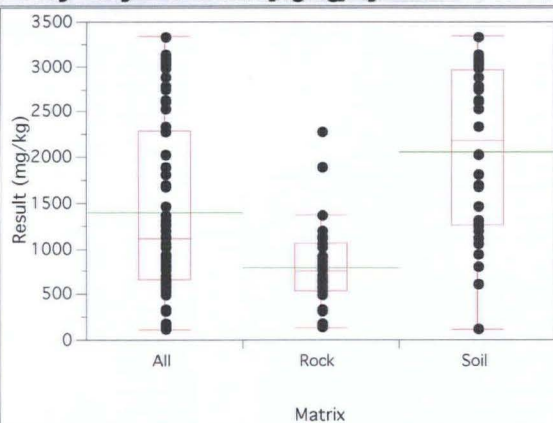


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	10.2	18.06	20.6	59.4	75	104.6	143
Rock	23.2	44.56	59.4	69.9	99.3	115.6	143
Soil	10.2	15.02	18.35	20.55	54.825	69.18	101

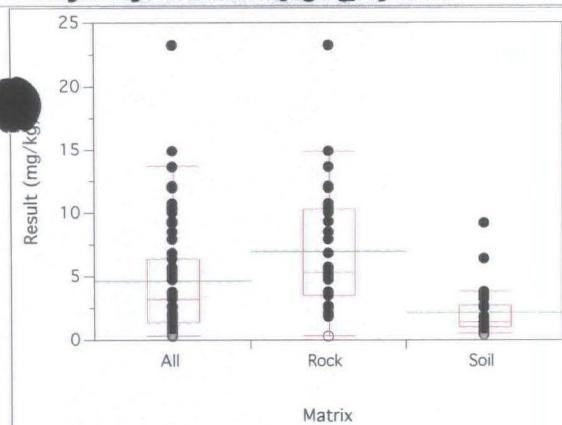
Rock Type-Chert, Chemical-Potassium

Oneway Analysis of Result (mg/kg) By Matrix

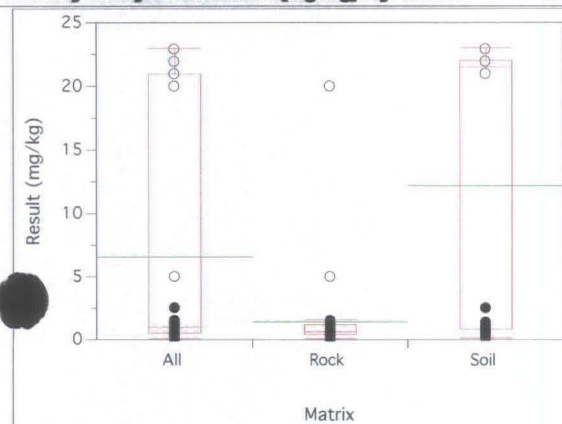


Quantiles

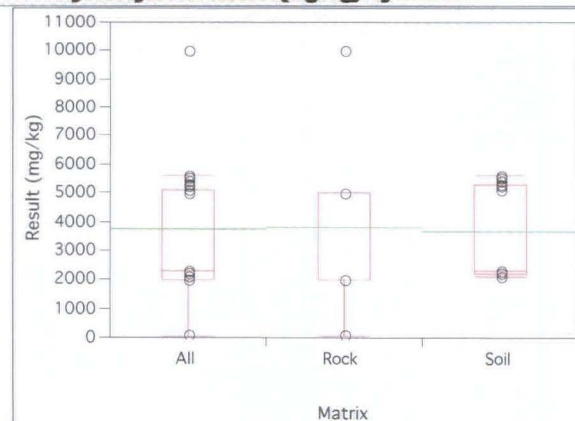
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	119	294.6	663	1110	2290	3032	3340
Rock	135	178.6	539	756	1060	1268	2290
Soil	119	843.2	1257.5	2180	2965	3087	3340

Rock Type-Chart, Chemical-Selenium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.35	0.772	1.4	3.2	6.4	10.54	23.3
Rock	0.35	1.86	3.5	5.3	10.3	12.74	23.3
Soil	0.51	0.637	1	1.4	2.7	3.74	9.2

Rock Type-Chart, Chemical-Silver**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

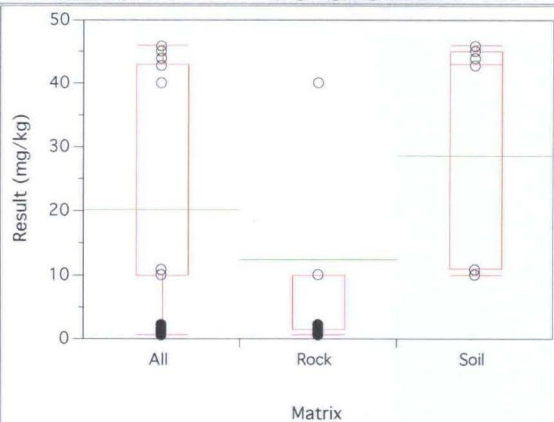
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.088	0.288	0.52	1	21	22	23
Rock	0.088	0.204	0.43	0.63	1.2	1.6	20
Soil	0.12	0.452	0.8275	21.5	22	23	23

Rock Type-Chart, Chemical-Sodium**Oneway Analysis of Result (mg/kg) By Matrix****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	64.1	2000	2000	2300	5100	5400	10000
Rock	64.1	1226.36	2000	5000	5000	7000	10000
Soil	2100	2200	2200	2300	5275	5400	5600

Rock Type-Chert, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Matrix

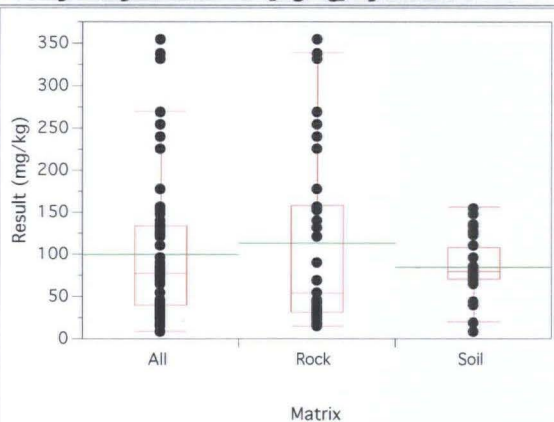


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.67	1.38	10	10	43	45	46
Rock	0.67	0.956	1.5	10	10	40	40
Soil	10	10	11	43	45	45	46

Rock Type-Chert, Chemical-Vanadium

Oneway Analysis of Result (mg/kg) By Matrix

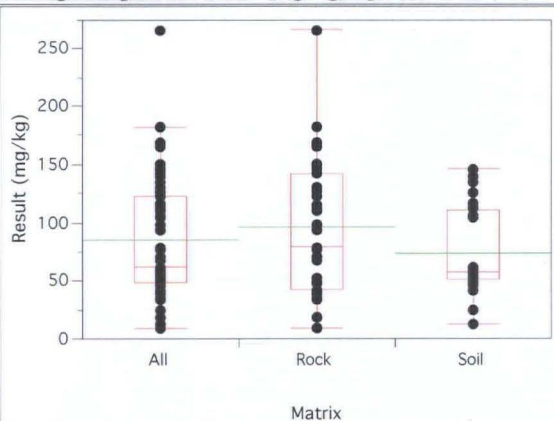


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	9	26.14	40.1	77.4	134	228.2	356
Rock	14.9	22.78	31.5	54.2	158	294.8	356
Soil	9	40.03	70.6	79.35	108.1	136.1	156

Rock Type-Chert, Chemical-Zinc

Oneway Analysis of Result (mg/kg) By Matrix



Quantiles

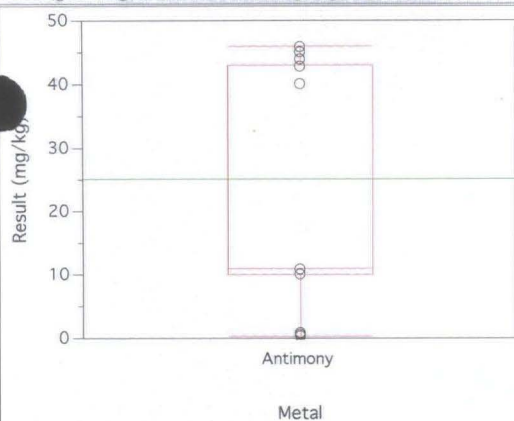
Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	9	37.6	48.6	62.3	123	153.2	267
Rock	9	35.52	42.4	79.1	142	169	267
Soil	12.5	43.53	50.825	57.15	110.5	137.8	146

Chert Sites

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Site-All Chart Sites, Matrix-All, Chemical-Antimony

Oneway Analysis of Result (mg/kg) By Metal

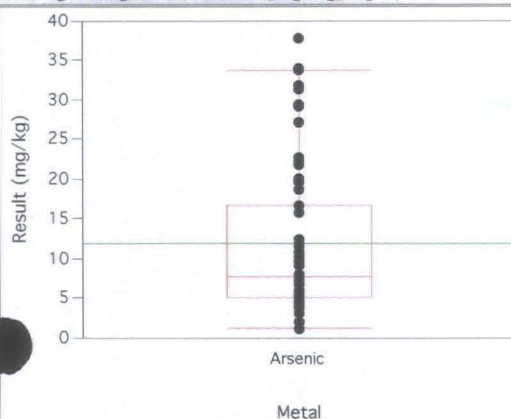


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Antimony	0.31	10	10	11	43	45	46

Site-All Chart Sites, Matrix-All, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Metal

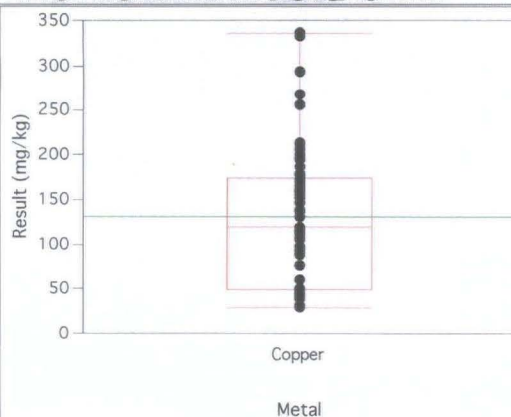


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Arsenic	1.3	4.08	5.2	7.8	16.8	29.16	37.9

Site-All Chart Sites, Matrix-All, Chemical-Copper

Oneway Analysis of Result (mg/kg) By Metal

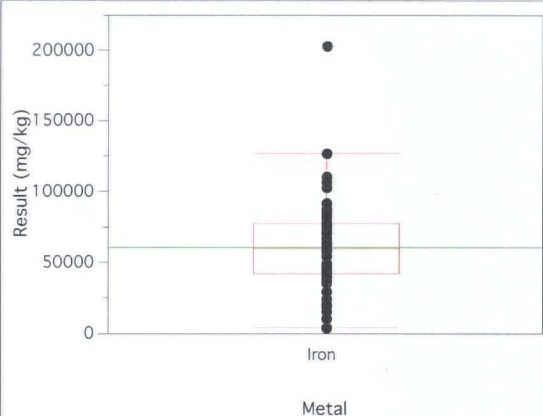


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Copper	29.1	45.12	49.5	119	174	212.6	336

Site-All Chert Sites, Matrix-All, Chemical-Iron

Oneway Analysis of Result (mg/kg) By Metal

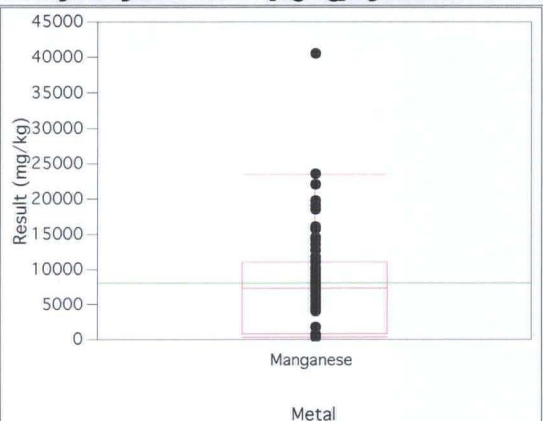


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Iron	4340	20580	42100	59600	77600	89300	203000

Site-All Chert Sites, Matrix-All, Chemical-Manganese

Oneway Analysis of Result (mg/kg) By Metal

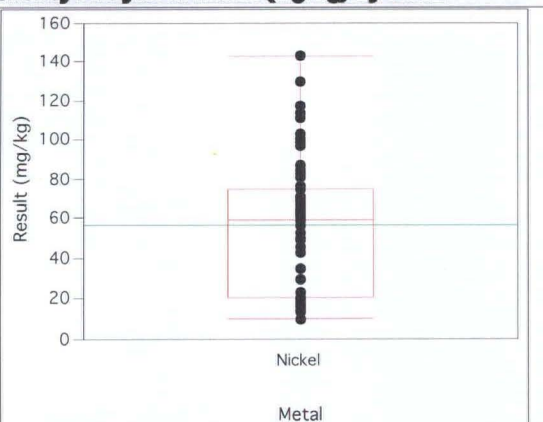


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Manganese	366	699.2	835	7400	11100	18800	40500

Site-All Chert Sites, Matrix-All, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Metal

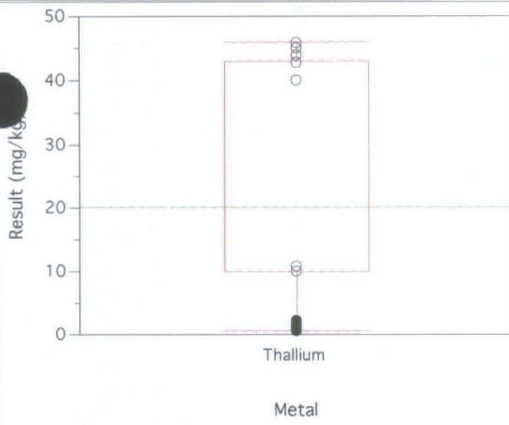


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Nickel	10.2	18.06	20.6	59.4	75	104.6	143

Site-All Chart Sites, Matrix-All, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Metal

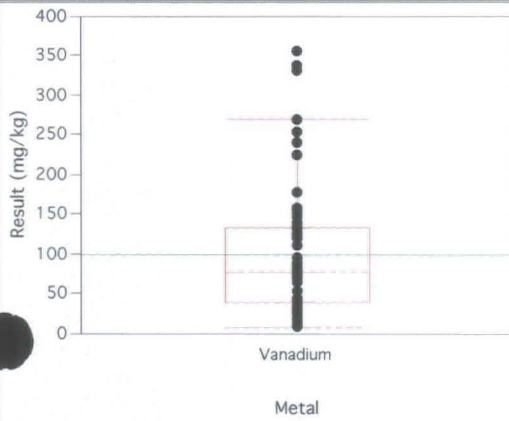


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Thallium	0.67	1.38	10	10	43	45	46

Site-All Chart Sites, Matrix-All, Chemical-Vanadium

Oneway Analysis of Result (mg/kg) By Metal

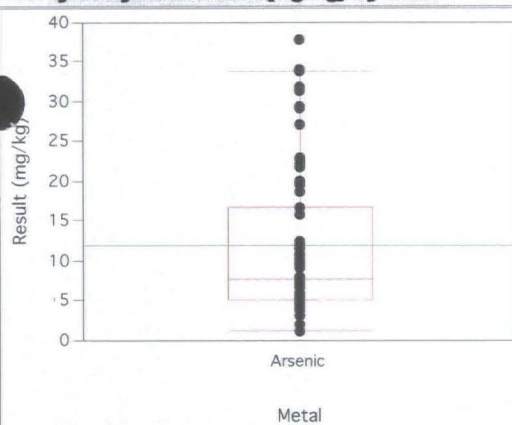


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Vanadium	9	26.14	40.1	77.4	134	228.2	356

Site-All Chart Sites, Matrix-All, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Metal

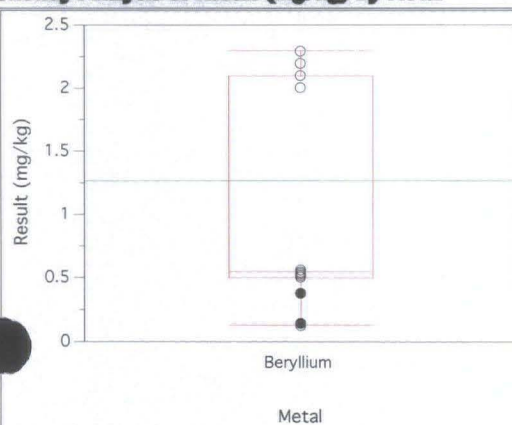


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Arsenic	1.3	4.08	5.2	7.8	16.8	29.16	37.9

Site-All Chart Sites, Matrix-All, Chemical-Beryllium

Oneway Analysis of Result (mg/kg) By Metal

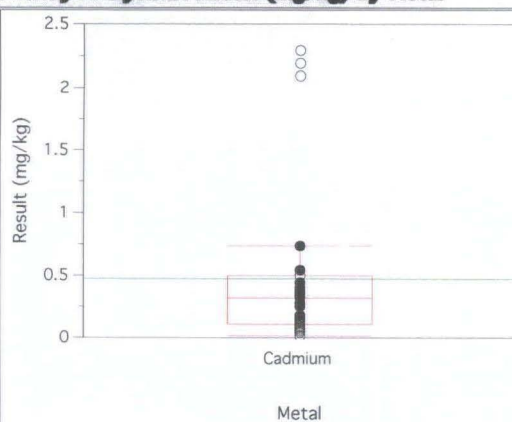


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Beryllium	0.13	0.5	0.5	0.55	2.1	2.2	2.3

Site-All Chart Sites, Matrix-All, Chemical-Cadmium

Oneway Analysis of Result (mg/kg) By Metal

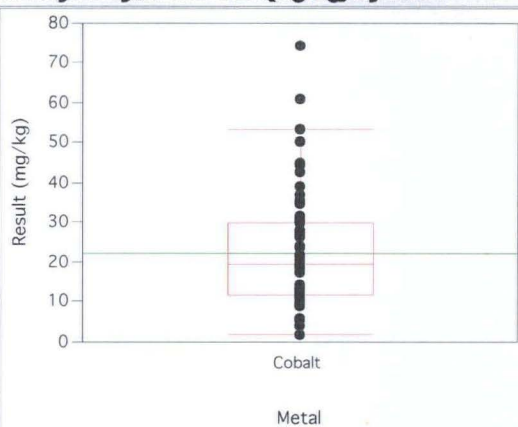


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Cadmium	0.016	0.059	0.11	0.32	0.5	2.12	2.3

Site-All Chert Sites, Matrix-All, Chemical-Cobalt

Oneway Analysis of Result (mg/kg) By Metal

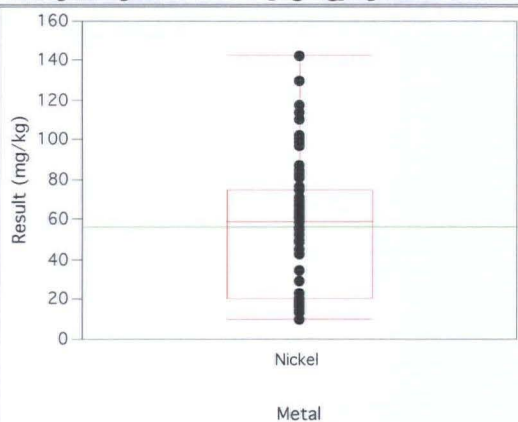


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Cobalt	1.9	9.46	11.7	19.5	30	43.06	74.4

Site-All Chert Sites, Matrix-All, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Metal

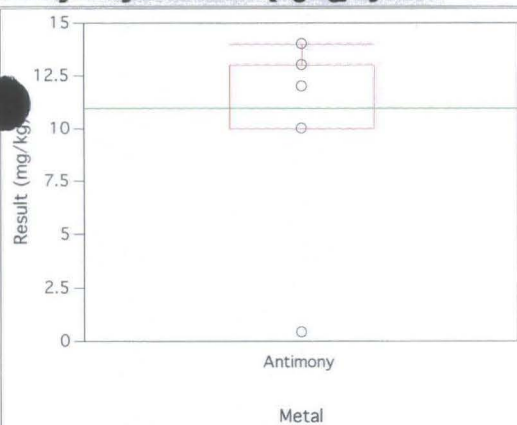


Quantiles

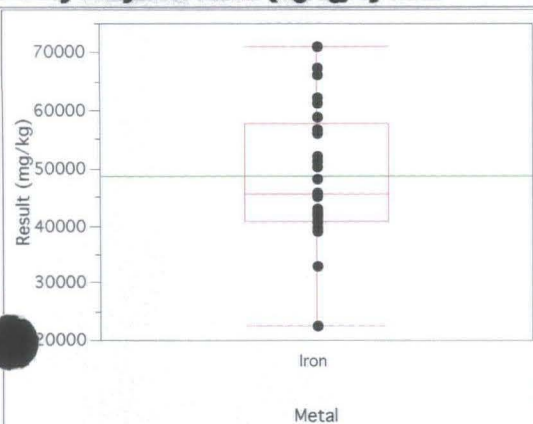
Level	Minimum	10%	25%	Median	75%	90%	Maximum
Nickel	10.2	18.06	20.6	59.4	75	104.6	143

Serpentinite Sites

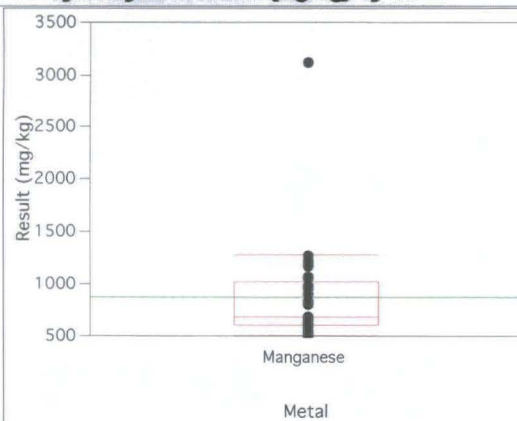
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Site-Serpentine Only, Matrix-AI, Chemical-Antimony**Oneway Analysis of Result (mg/kg) By Metal****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Antimony	0.46	10	10	10	13	13	14

Site-Serpentine Only, Matrix-AI, Chemical-Iron**Oneway Analysis of Result (mg/kg) By Metal****Quantiles**

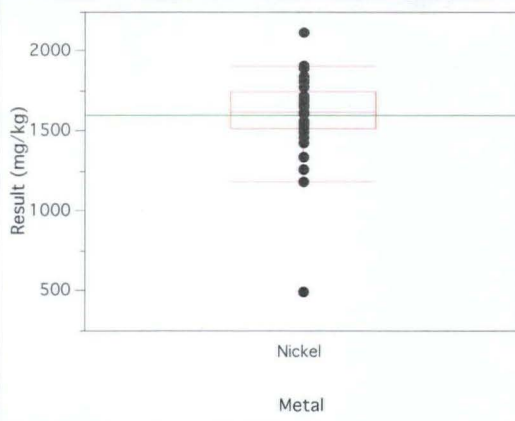
Level	Minimum	10%	25%	Median	75%	90%	Maximum
Iron	22600	38980	40850	45600	57850	66300	71100

Site-Serpentine Only, Matrix-AI, Chemical-Manganese**Oneway Analysis of Result (mg/kg) By Metal****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Manganese	506	525.6	606	686	1022.5	1214	3130

Site-Serpentinite Only, Matrix-All, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Metal

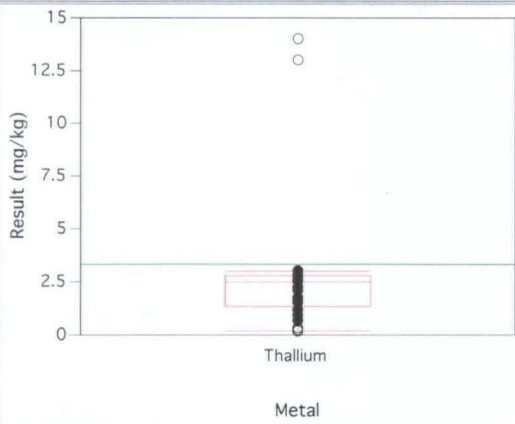


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Nickel	499	1292	1520	1620	1750	1876	2120

Site-Serpentinite Only, Matrix-All, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Metal

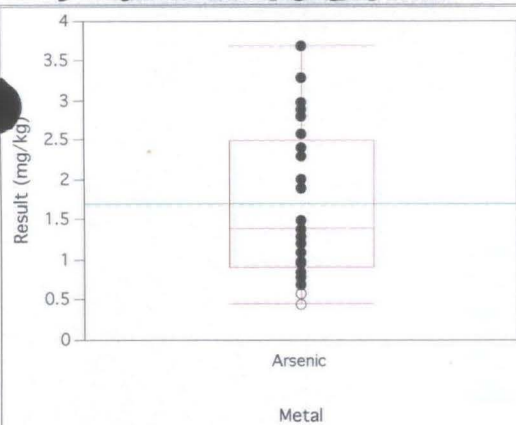


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Thallium	0.21	0.34	1.35	2.5	2.8	13	14

Site-Serpentinite Only, Matrix-All, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Metal

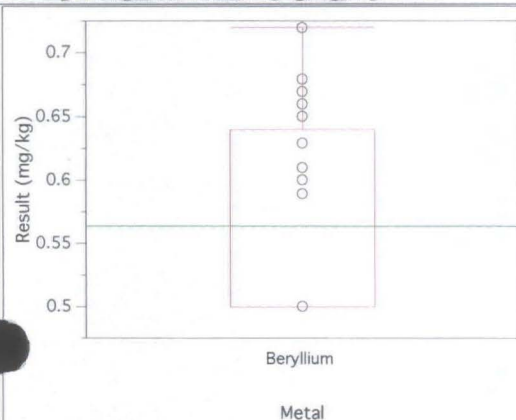


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Arsenic	0.46	0.726	0.91	1.4	2.5	3	3.7

Site-Serpentinite Only, Matrix-All, Chemical-Beryllium

Oneway Analysis of Result (mg/kg) By Metal

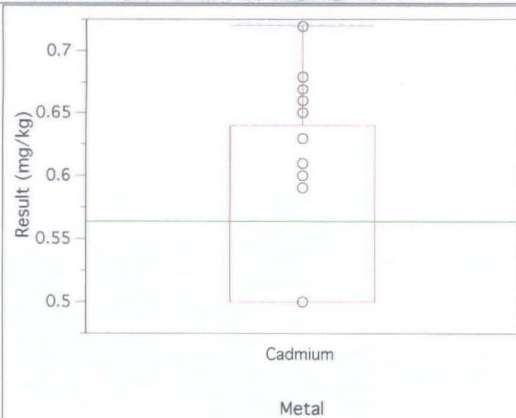


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Beryllium	0.5	0.5	0.5	0.5	0.64	0.67	0.72

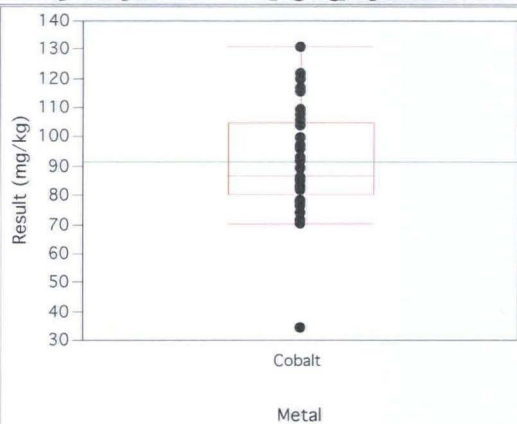
Site-Serpentinite Only, Matrix-All, Chemical-Cadmium

Oneway Analysis of Result (mg/kg) By Metal

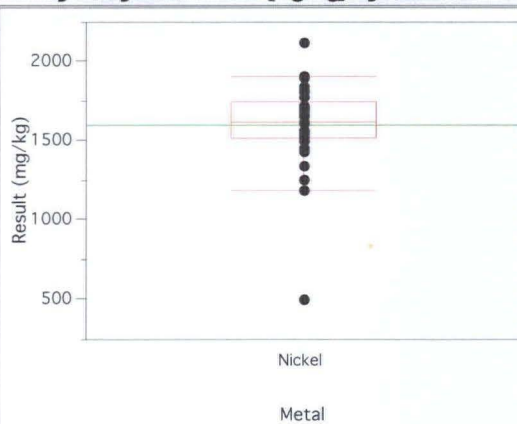


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Cadmium	0.5	0.5	0.5	0.5	0.64	0.67	0.72

Site-Serpentinite Only, Matrix-All, Chemical-Cobalt**Oneway Analysis of Result (mg/kg) By Metal****Quantiles**

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Cobalt	34.3	72.94	80.5	86.7	105	118.8	131

Site-Serpentinite Only, Matrix-All, Chemical-Nickel**Oneway Analysis of Result (mg/kg) By Metal****Quantiles**

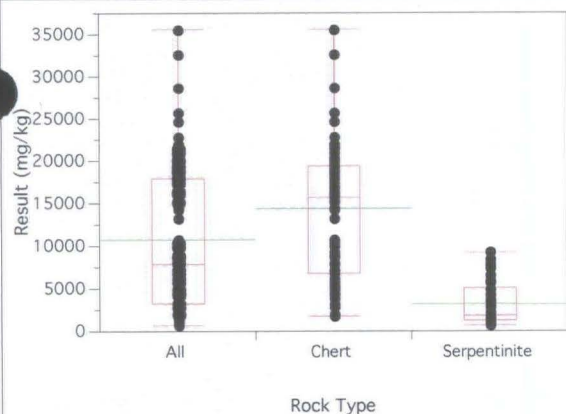
Level	Minimum	10%	25%	Median	75%	90%	Maximum
Nickel	499	1292	1520	1620	1750	1876	2120

All Sites

**All metals by matrix and combined
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Site-All Sites, Chemical-Aluminum

Oneway Analysis of Result (mg/kg) By Rock Type

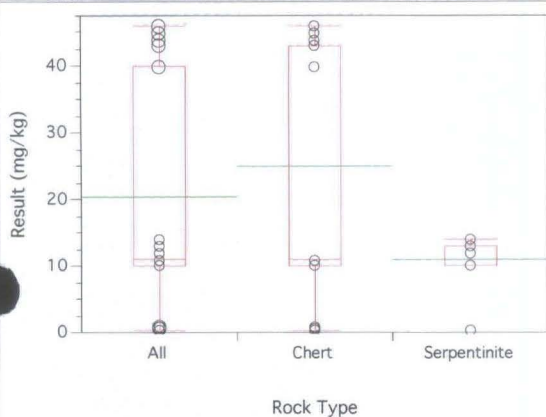


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	689	1280	3250	7885	17925	21490	35600
Chert	1740	4280	6780	15700	19400	22700	35600
Serpentinite	689	817.9	1245	1800	5057.5	7777	9180

Site-All Sites, Chemical-Antimony

Oneway Analysis of Result (mg/kg) By Rock Type

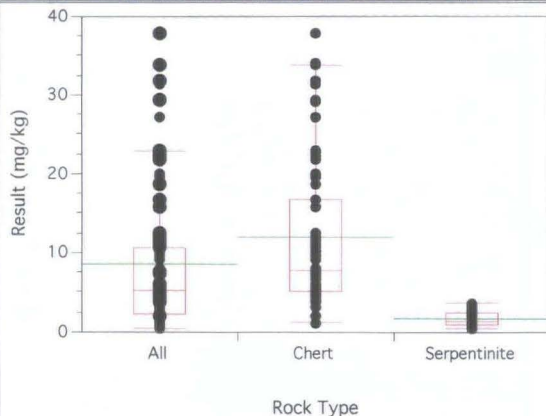


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.31	10	10	11	40	44.9	46
Chert	0.31	10	10	11	43	45	46
Serpentinite	0.46	10	10	10	13	13	14

Site-All Sites, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Rock Type

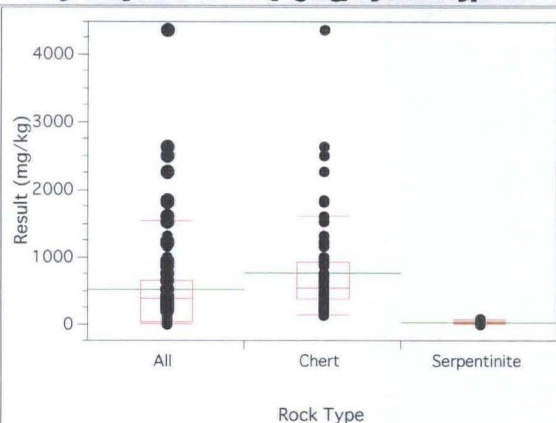


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.46	0.973	2.3	5.25	10.625	22.75	37.9
Chert	1.3	4.1	5.2	7.8	16.8	29.1	37.9
Serpentinite	0.46	0.753	0.935	1.4	2.45	3	3.7

Site--All Sites, Chemical--Barium

Oneway Analysis of Result (mg/kg) By Rock Type

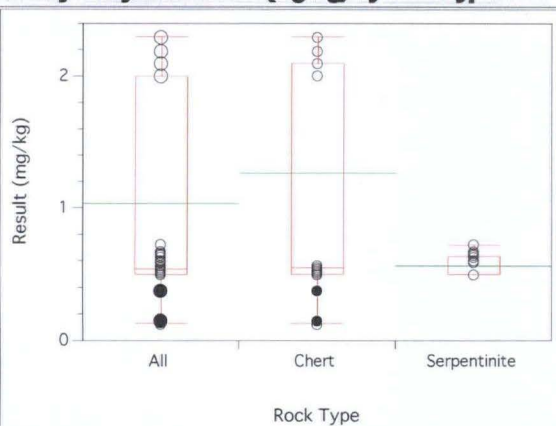


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.94	4.05	34.225	380.5	653	1229	4390
Chert	139	239	380	539	925	1610	4390
Serpentinite	0.94	1.65	3.55	7.6	34.225	58.51	63.6

Site--All Sites, Chemical--Beryllium

Oneway Analysis of Result (mg/kg) By Rock Type

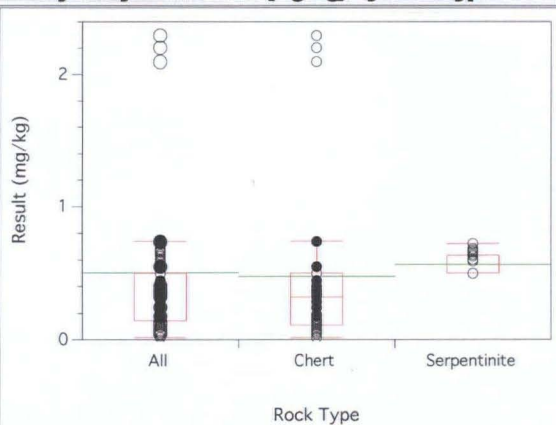


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.13	0.5	0.5	0.54	2	2.2	2.3
Chert	0.13	0.5	0.5	0.55	2.1	2.2	2.3
Serpentinite	0.5	0.5	0.5	0.5	0.635	0.67	0.72

Site--All Sites, Chemical--Cadmium

Oneway Analysis of Result (mg/kg) By Rock Type

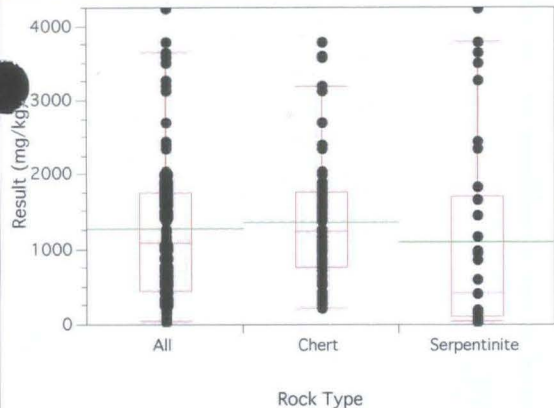


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.016	0.065	0.1425	0.5	0.5	0.679	2.3
Chert	0.016	0.06	0.11	0.32	0.5	2.1	2.3
Serpentinite	0.5	0.5	0.5	0.5	0.635	0.67	0.72

Site-All Sites, Chemical-Calcium

Oneway Analysis of Result (mg/kg) By Rock Type

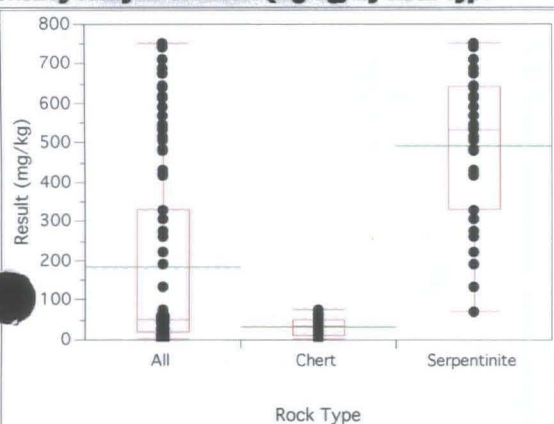


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	43.2	144.9	450	1080	1752.5	3086	4240
Chert	221	391	765	1240	1760	2390	3790
Serpentine	43.2	60.21	106.75	419	1700	3545	4240

Site-All Sites, Chemical-Chromium

Oneway Analysis of Result (mg/kg) By Rock Type

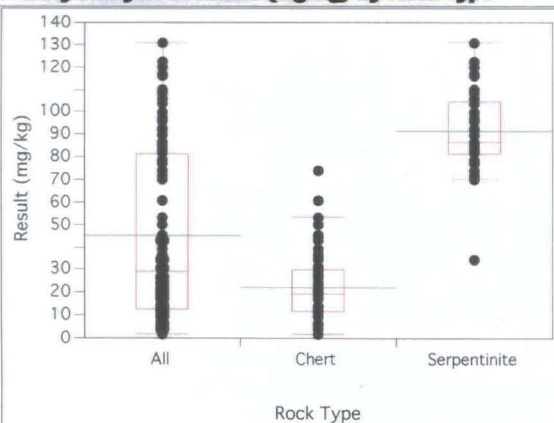


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2.7	9.13	20.7	51.45	331.75	639.6	752
Chert	2.7	8	12.2	34.7	51.5	57	77.1
Serpentine	72.9	213.7	331.75	533	642.75	696.6	752

Site-All Sites, Chemical-Cobalt

Oneway Analysis of Result (mg/kg) By Rock Type

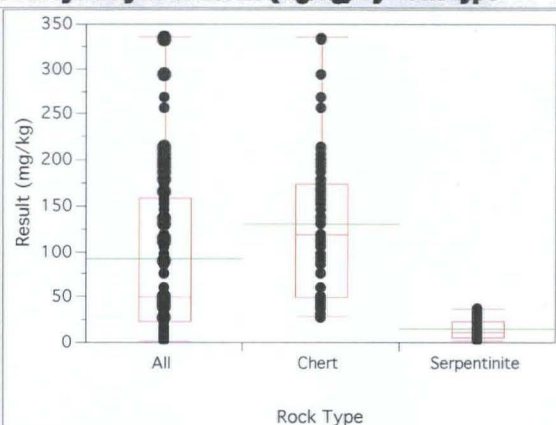


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	1.9	10.93	12.65	29.05	81.3	99.56	131
Chert	1.9	9.5	11.7	19.5	30	42.7	74.4
Serpentine	34.3	73.72	81.3	86.7	104.5	117.9	131

Site--All Sites, Chemical--Copper

Oneway Analysis of Result (mg/kg) By Rock Type

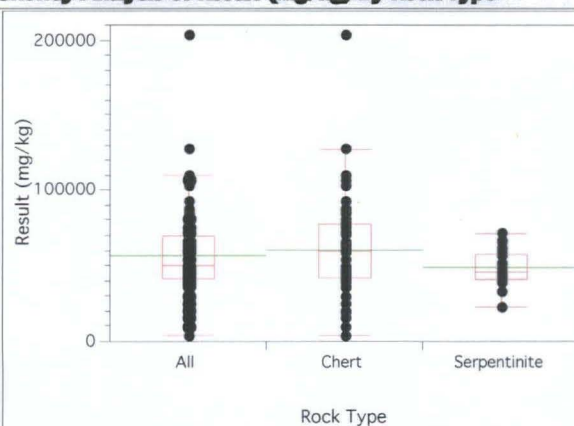


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	2.1	6.12	23.425	49.95	158.75	197.9	336
Chert	29.1	45.3	49.5	119	174	212	336
Serpentinite	2.1	3.59	5.3	11.1	23.425	33.66	37

Site--All Sites, Chemical--Iron

Oneway Analysis of Result (mg/kg) By Rock Type

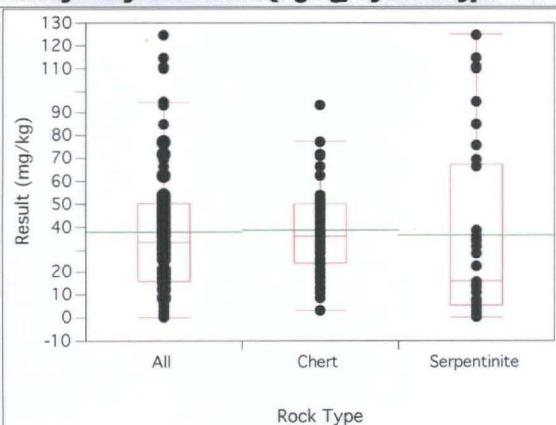


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	4340	29410	41425	50000	69825	86390	203000
Chert	4340	20700	42100	59600	77600	88500	203000
Serpentinite	22600	39040	40925	45600	57375	66300	71100

Site--All Sites, Chemical--Lead

Oneway Analysis of Result (mg/kg) By Rock Type

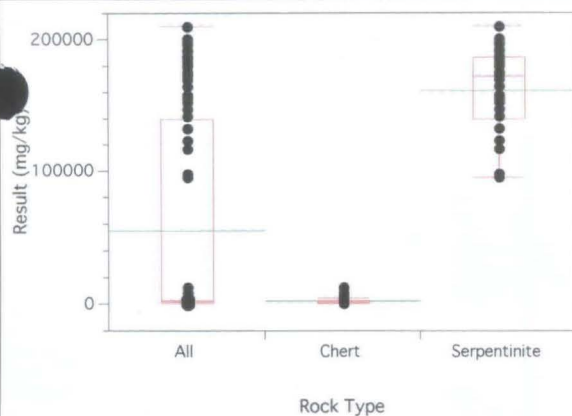


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.19	5.73	16.175	33.3	50.35	75.14	125
Chert	3.3	12.9	24.1	36	50.2	71.3	93.7
Serpentinite	0.19	1.14	5.45	16.1	67.325	110.3	125

Site-All Sites, Chemical-Magnesium

Oneway Analysis of Result (mg/kg) By Rock Type

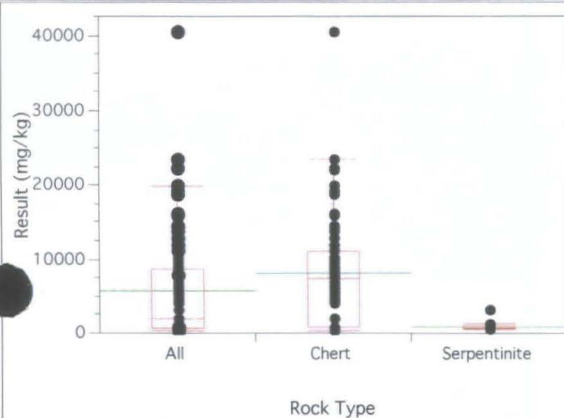


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	385	821.7	1775	2645	139750	183700	210000
Chert	385	716	1210	2320	2650	5090	11900
Serpentinite	95200	116000	139750	172000	186250	196600	210000

Site-All Sites, Chemical-Manganese

Oneway Analysis of Result (mg/kg) By Rock Type

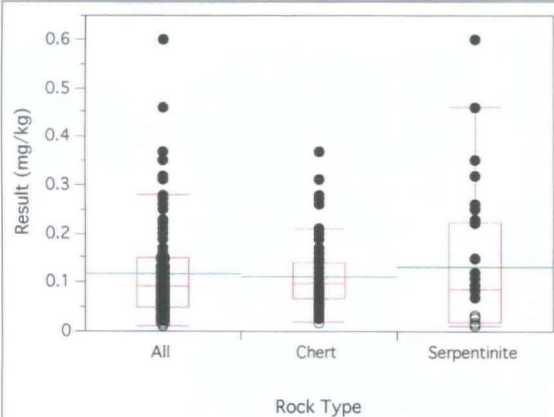


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	366	599.6	701.25	2005	8655	14480	40500
Chert	366	700	835	7400	11100	18700	40500
Serpentinite	506	528.3	610	686	1008.75	1202	3130

Site-All Sites, Chemical-Mercury

Oneway Analysis of Result (mg/kg) By Rock Type

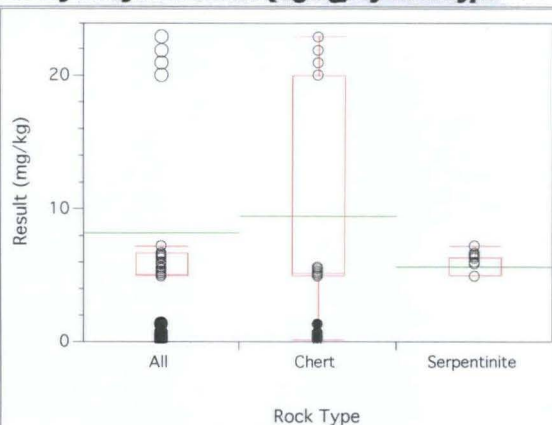


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.011	0.02	0.049	0.0925	0.15	0.259	0.6
Chert	0.02	0.043	0.068	0.099	0.14	0.21	0.37
Serpentinite	0.011	0.0127	0.019	0.087	0.2225	0.329	0.6

Site--All Sites, Chemical--Molybdenum

Oneway Analysis of Result (mg/kg) By Rock Type

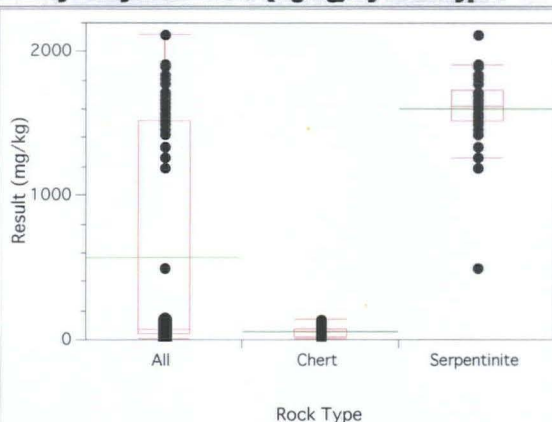


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.16	0.563	5	5.1	6.7	20	23
Chert	0.16	0.4	5	5.2	20	22	23
Serpentinite	5	5	5	5	6.35	6.7	7.2

Site--All Sites, Chemical--Nickel

Oneway Analysis of Result (mg/kg) By Rock Type

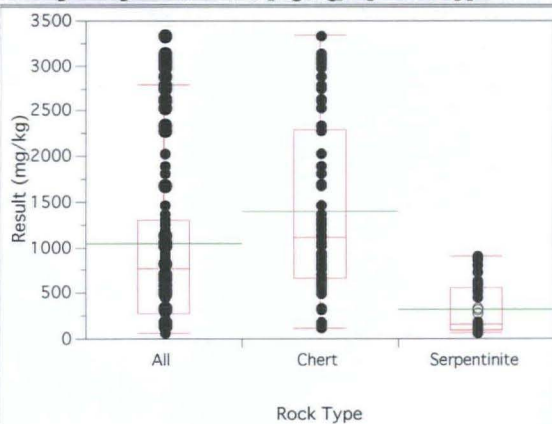


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	10.2	19.2	43.6	73.35	1520	1709	2120
Chert	10.2	18.1	20.6	59.4	75	103	143
Serpentinite	499	1316	1520	1620	1735	1858	2120

Site--All Sites, Chemical--Potassium

Oneway Analysis of Result (mg/kg) By Rock Type

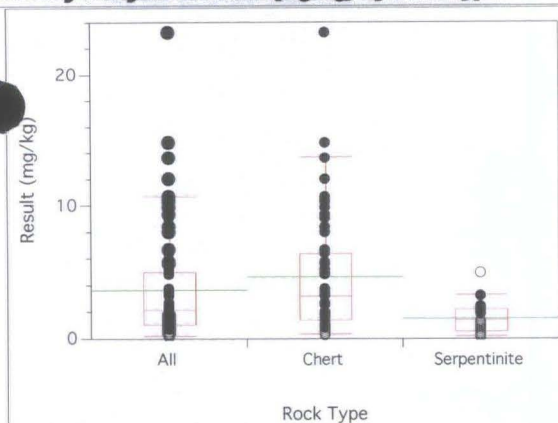


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	64.1	98.74	276.75	772	1302.5	2871	3340
Chert	119	323	663	1110	2290	3030	3340
Serpentinite	64.1	71.05	93.775	155	556	818.2	899

Site-All Sites, Chemical-Selenium

Oneway Analysis of Result (mg/kg) By Rock Type

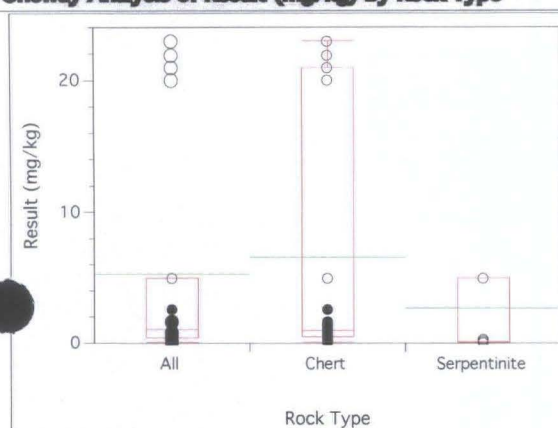


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.18	0.511	1.025	2.15	5	9.94	23.3
Chert	0.35	0.79	1.4	3.2	6.4	10.5	23.3
Serpentinite	0.18	0.383	0.535	1.4	2.2	3.3	5

Site-All Sites, Chemical-Silver

Oneway Analysis of Result (mg/kg) By Rock Type

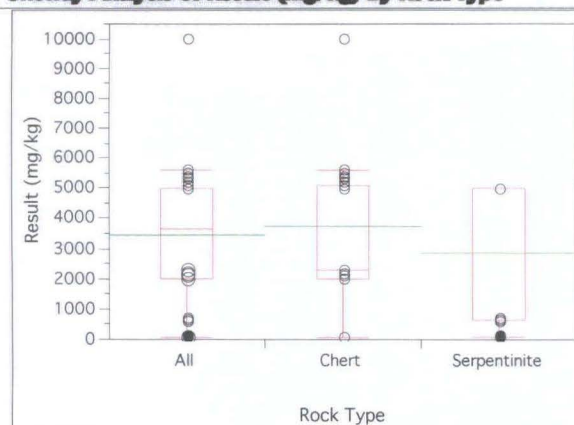


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.052	0.121	0.4025	1.05	5	22	23
Chert	0.088	0.29	0.52	1	21	22	23
Serpentinite	0.052	0.0936	0.1275	5	5	5	5

Site-All Sites, Chemical-Sodium

Oneway Analysis of Result (mg/kg) By Rock Type

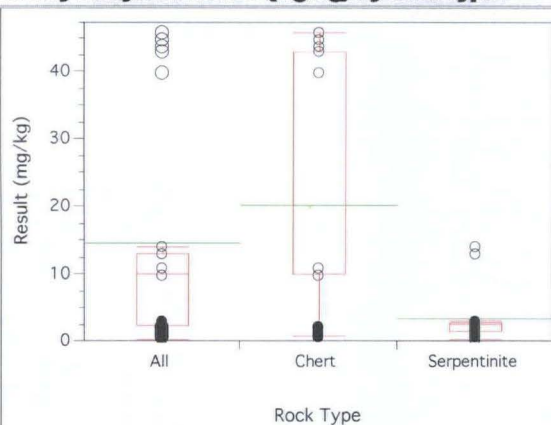


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	64.1	612	2000	3650	5000	5300	10000
Chert	64.1	2000	2000	2300	5100	5400	10000
Serpentinite	85.7	597	645	5000	5000	5000	5000

Site-All Sites, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Rock Type

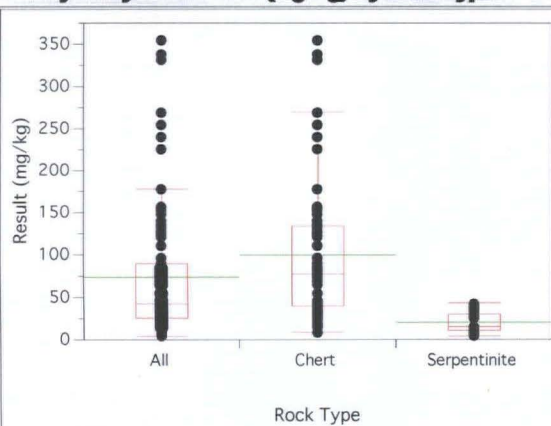


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	0.21	0.974	2.3	10	13	44.9	46
Chert	0.67	1.4	10	10	43	45	46
Serpentine	0.21	0.355	1.425	2.5	2.75	13	14

Site-All Sites, Chemical-Vanadium

Oneway Analysis of Result (mg/kg) By Rock Type

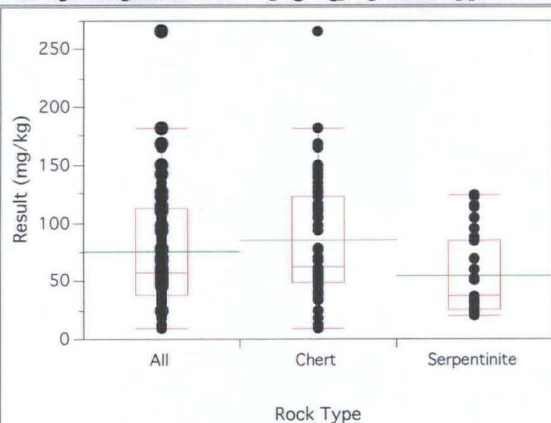


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	4	11.39	25.375	42.75	89.625	156	356
Chert	9	26.6	40.1	77.4	134	225	356
Serpentine	4	6.24	11.05	15.6	30.2	36.35	43.6

Site-All Sites, Chemical-Zinc

Oneway Analysis of Result (mg/kg) By Rock Type

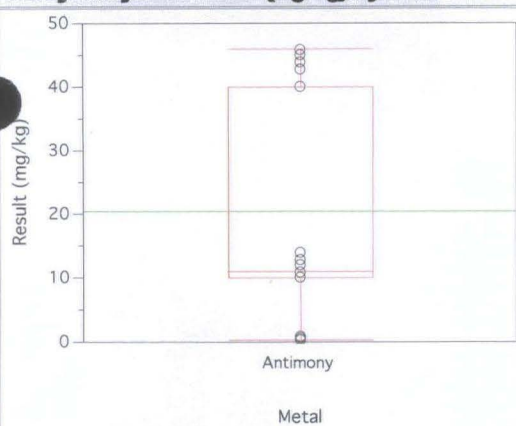


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
All	9	24.63	38.175	57.15	112.75	141.8	267
Chert	9	38	48.6	62.3	123	150	267
Serpentine	20.2	20.95	25.15	37.3	84.85	117.1	124

Site-All Sites Combined, Matrix-All, Chemical-Antimony

Oneway Analysis of Result (mg/kg) By Metal

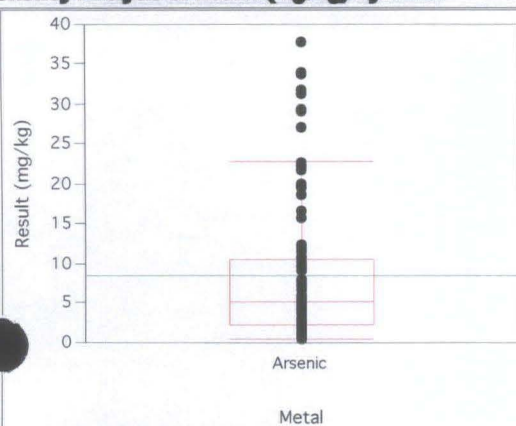


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Antimony	0.31	10	10	11	40	44.9	46

Site-All Sites Combined, Matrix-All, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Metal

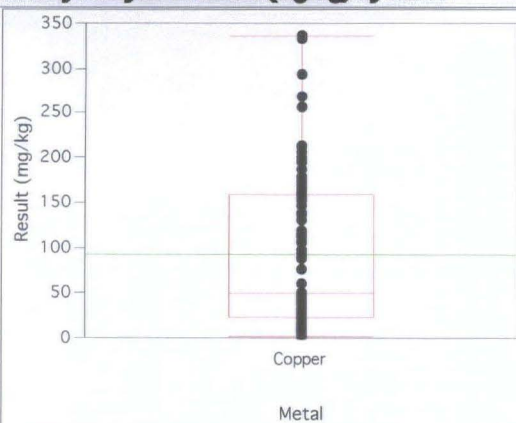


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Arsenic	0.46	0.973	2.3	5.25	10.625	22.75	37.9

Site-All Sites Combined, Matrix-All, Chemical-Copper

Oneway Analysis of Result (mg/kg) By Metal

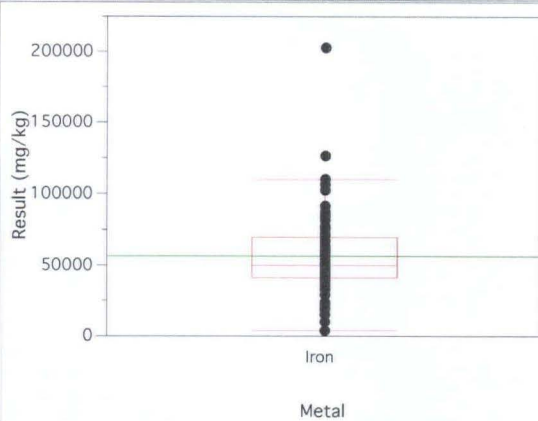


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Copper	2.1	6.12	23.425	49.95	158.75	197.9	336

Site-All Sites Combined, Matrix-All, Chemical-Iron

Oneway Analysis of Result (mg/kg) By Metal

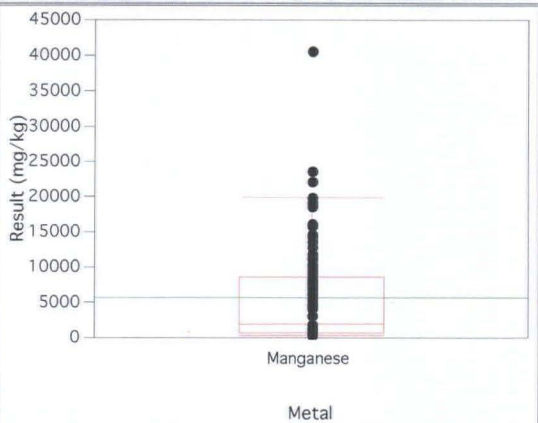


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Iron	4340	29410	41425	50000	69825	86390	203000

Site-All Sites Combined, Matrix-All, Chemical-Manganese

Oneway Analysis of Result (mg/kg) By Metal

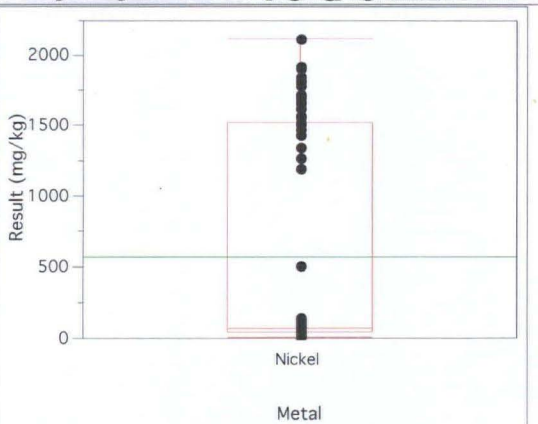


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Manganese	366	599.6	701.25	2005	8655	14480	40500

Site-All Sites Combined, Matrix-All, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Metal

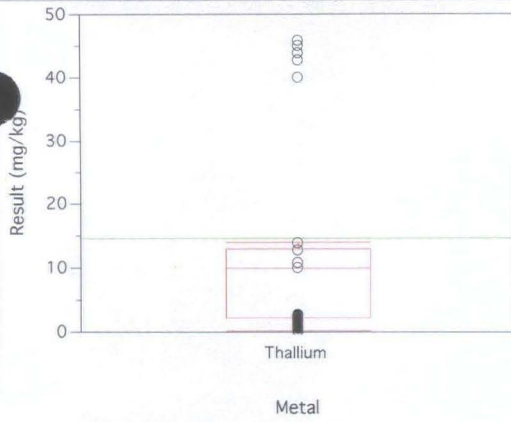


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Nickel	10.2	19.2	43.6	73.35	1520	1709	2120

Site-All Sites Combined, Matrix-All, Chemical-Thallium

Oneway Analysis of Result (mg/kg) By Metal

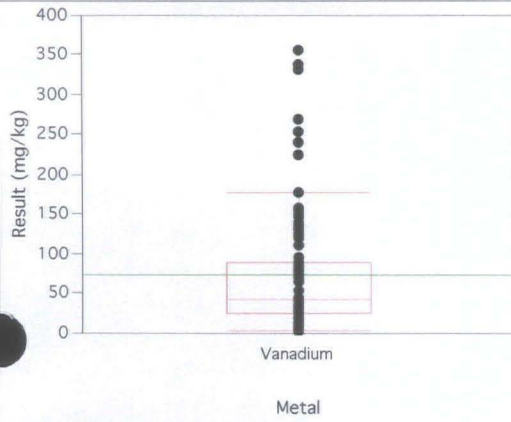


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Thallium	0.21	0.974	2.3	10	13	44.9	46

Site-All Sites Combined, Matrix-All, Chemical-Vanadium

Oneway Analysis of Result (mg/kg) By Metal

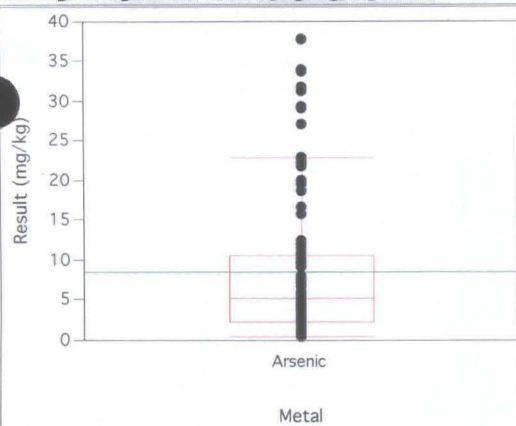


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Vanadium	4	11.39	25.375	42.75	89.625	156	356

Site-All Sites Combined, Matrix-AI, Chemical-Arsenic

Oneway Analysis of Result (mg/kg) By Metal

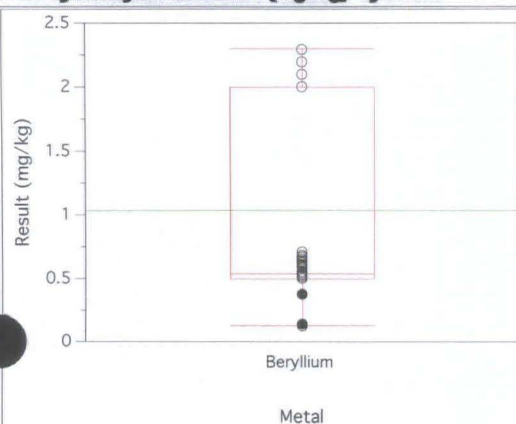


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Arsenic	0.46	0.973	2.3	5.25	10.625	22.75	37.9

Site-All Sites Combined, Matrix-AI, Chemical-Beryllium

Oneway Analysis of Result (mg/kg) By Metal

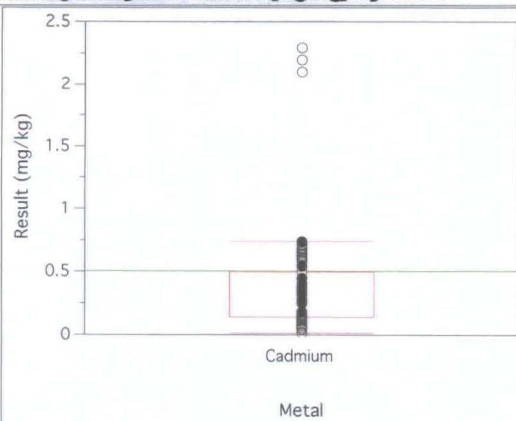


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Beryllium	0.13	0.5	0.5	0.54	2	2.2	2.3

Site-All Sites Combined, Matrix-AI, Chemical-Cadmium

Oneway Analysis of Result (mg/kg) By Metal

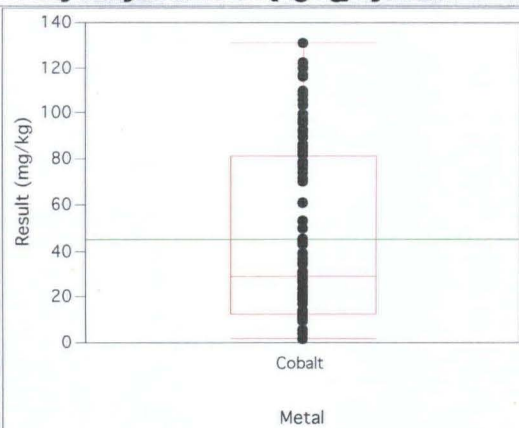


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Cadmium	0.016	0.065	0.1425	0.5	0.5	0.679	2.3

Site-All Sites Combined, Matrix-AI, Chemical-Cobalt

Oneway Analysis of Result (mg/kg) By Metal

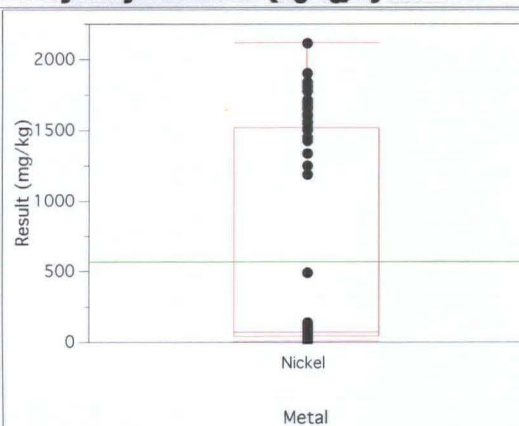


Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Cobalt	1.9	10.93	12.65	29.05	81.3	99.56	131

Site-All Sites Combined, Matrix-AI, Chemical-Nickel

Oneway Analysis of Result (mg/kg) By Metal



Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Nickel	10.2	19.2	43.6	73.35	1520	1709	2120

APPENDIX C
RISK EVALUATION

CONTENTS

1.0	INTRODUCTION	C-1
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3.0	RISK EVALUATION METHODOLOGY	C-3
3.1	CARCINOGENIC RISKS.....	C-3
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Figure

C-1	Estimated Cancer Risk, Innes Avenue Site
C-2	Estimated Hazard Index, Innes Avenue Site
C-3	Estimated Cancer Risk, Twin Peaks Site
C-4	Estimated Hazard Index, Twin Peaks Site
C-5	Estimated Cancer Risk, Malta & O'Shaughnessey Site
C-6	Hazard Index, Malta & O'Shaughnessey Site
C-7	Estimated Cancer Risk, All Sites
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Table

C-1	Exposure Parameters Used in Calculating HPS-specific PRGs
C-2	Chemical-Specific Values Used in Calculation of HPS-Specific PRGs
C-3	HPS-Specific PRGs

1.0 INTRODUCTION

The potential risk to human health posed by the ambient metal concentrations at the three regional bedrock locations was evaluated by estimating the excess lifetime cancer risk (ELCR) and hazard index (HI) for residential exposure to metals. To estimate the ELCR and HI for each sampling location, metals data from the three regional bedrock sites were compared to HPS-specific PRGs. HPS-specific PRGs are health-based concentrations for individual chemicals in soil and correspond to an ELCR of 1×10^{-6} or a noncancer hazard quotient (HQ) of 1. HPS-specific PRGs assume the following exposure pathways:

- Ingestion of soil
- Dermal contact with soil
- Inhalation of volatiles and particulates from soil
- Ingestion of homegrown produce

The exposure parameters and toxicity values used to calculate the HPS-specific PRGs were based on the exposure parameters and toxicity values used to develop the U.S. Environmental Protection Agency (EPA) Region IX residential PRGs (EPA 2002), with the exception of the homegrown produce pathway and California Environmental Protection Agency (Cal/EPA) toxicity criteria. Exposure parameters used to calculate the homegrown produce pathway were derived from EPA sources. Cal/EPA toxicity criteria were used in lieu of EPA toxicity criteria when the Cal/EPA toxicity criteria were more conservative. For metals with both carcinogenic and noncarcinogenic endpoints, separate HPS-specific PRGs were calculated for both endpoints.

2.0 HPS-SPECIFIC PRGS

HPS-specific PRGs are health-based concentrations for individual chemicals in soil and correspond to an ELCR of 1×10^{-6} or a noncancer HQ of 1. The exposure pathways included in the HPS-specific PRGs are: (1) ingestion of soil, (2) dermal contact with soil, (3) inhalation of volatiles and particulates, and (4) ingestion of homegrown produce.

The equations used to calculate the HPS-specific PRGs are the same as those used to calculate the U.S. Environmental Protection Agency, Region IX (EPA) preliminary remediation goals (PRG), with the exception of the ingestion of homegrown produce pathway, which is not a pathway considered in the calculation of the EPA PRGs. The equation for the homegrown produce pathway was developed under the same methodology as the PRG-based equations used to calculate exposure for the other three pathways. The equations backcalculate a soil concentration from a target risk (for carcinogens) or hazard quotient (for noncarcinogens). The equations simultaneously combine risks from ingestion, dermal contact, inhalation, and ingestion of homegrown produce.

For carcinogenic metals, carcinogenic risks during the first 30 years of life were calculated using age-adjusted factors (adj). These factors approximate the integrated exposure from birth until age 30 combining contact rates, body weights, and exposure durations for two groups – small children and adults. All exposure parameters used in the following equations are presented in Tables C-1 and C-2. The age-adjusted factors for the four pathways (ingestion, dermal contact, inhalation, and ingestion of homegrown produce) were calculated as follows:

- (1) ingestion ([mg-yr]/[kg-d]):

$$IFS_{adj} = \frac{ED_c \times IRS_c}{BW_c} + \frac{(ED_r - ED_c) \times IRS_a}{BW_a}$$

- (2) dermal contact ([mg-yr]/[kg-d]):

$$SFS_{adj} = \frac{ED_c \times AF_c \times SA_c}{BW_c} + \frac{(ED_r - ED_c) \times AF_a \times SA_a}{BW_a}$$

- (3) inhalation ([m³-yr]/[kg-d]):

$$InhF_{adj} = \frac{ED_c \times IRA_c}{BW_c} + \frac{(ED_r - ED_c) \times IRA_a}{BW_a}$$

- (4) produce ingestion ([g-yr]/[kg-d]):

$$Pr od_{adj} = \frac{ED_c \times IPR_c}{BW_c} + \frac{(ED_r - ED_c) \times IPR_a}{BW_a}$$

The equation for exposure to carcinogenic metals utilizes the above age-adjusted factors and is as follows:

Combined Exposures to Carcinogenic Metals in Residential Soil

$$C(\text{mg/kg}) = \frac{TR \times AT_c}{EF_r \left[\left(\frac{IFS_{adj} \times CSF_o}{10^6 \text{ mg/kg}} \right) + \left(\frac{SFS_{adj} \times ABS \times CSF_o}{10^6 \text{ mg/kg}} \right) + \left(\frac{InhF_{adj} \times CSF_i}{VF \text{ or } PEF} \right) + \left(\frac{Pr od_{adj} \times UF \times CSF_o}{10^3 \text{ g/kg}} \right) \right]}$$

Noncarcinogenic metals are evaluated in children separately from adults. No age-adjustment factor is used in this case.

Combined Exposures to Noncarcinogenic Metals in Residential Soil

$$C(\text{mg/kg}) = \frac{THQ \times BW_c \times AT_n}{EF_r \times ED_c \left[\left(\frac{I}{RfD_o} \times \frac{IRSc}{10^6 \text{ mg/kg}} \right) + \left(\frac{I}{RfD_o} \times \frac{SA_c \times AF \times ABS}{10^6 \text{ mg/kg}} \right) + \left(\frac{I}{RfD_i} \times \frac{IRAc}{VF \text{ or } PEF} \right) + \left(\frac{I}{RfD_o} \times \frac{IPR_c \times UF}{10^3 \text{ g/kg}} \right) \right]}$$

The HPS-specific PRGs were calculated using the above equations and the exposure parameters and chemical-specific parameters presented in Tables C-1 and C-2. The HPS-specific PRGs are presented in Table C-3.

3.0 RISK EVALUATION METHODOLOGY

3.1 CARCINOGENIC RISKS

For carcinogens, the cancer risk associated with exposure to a single metal is estimated by comparing the metals concentration in a given sample to the carcinogenic HPS-specific PRG, using the following equation:

$$\text{Cancer Risk} = (C/\text{HPS-specific PRG}) \times 10^{-6}$$

where:

C	=	Metal concentration in given sample (mg/kg)
HPS-specific PRG	=	Hunters Point Shipyard-specific carcinogenic preliminary remediation goal (mg/kg)

The total ELCR from exposure to multiple metals is calculated using the following equation:

$$ELCR = 10^{-6} \times \{(C_1/\text{HPS-specific PRG}_1) + (C_2/\text{HPS-specific PRG}_2) + (C_n/\text{HPS-specific PRG}_n)\}$$

where:

ELCR	=	Estimated lifetime cancer risk from exposure to all metals (unitless)
C _n	=	Concentration of metal n (mg/kg)
HPS-specific PRG _n	=	Hunters Point Shipyard-specific carcinogenic preliminary remediation goal for metal n (mg/kg)

3.2 NONCANCER HEALTH HAZARDS

For metals not classified as carcinogens and for those carcinogens known to cause adverse health effects other than cancer, the potential for residents to develop adverse health effects is evaluated by comparing the metals concentrations to the noncancer HPS-specific PRGs. When calculated for a single metal, this comparison estimates an HQ and is expressed in the following equation:

$$HQ = C/HPS\text{-specific PRG}$$

where:

HQ = Metal-specific individual hazard quotient

C = Metal concentration in given sample (mg/kg)

HPS-specific PRG = Hunters Point-Specific noncarcinogenic PRG (mg/kg)

To evaluate the potential for noncarcinogenic effects from exposure to multiple metals, the HQs for all chemicals are summed, yielding an HI as follows:

$$HI = \{(C_1/HPS\text{-specific PRG}_1) + (C_2/HPS\text{-specific PRG}_2) + (C_n/HPS\text{-specific PRG}_n)\}$$

where:

HI = Cumulative hazard index from exposure to all metals (unitless)

C_n = Concentration of metal n (mg/kg)

HPS-specific PRG_n = Hunters Point-Specific noncarcinogenic PRG for metal n (mg/kg)

A total HI of less than 1 indicates no potential for adverse noncarcinogenic health effects. If the HI exceeds 1, it may indicate the potential exists for adverse noncarcinogenic health effects to occur.

4.0 RISK EVALUATION

The potential carcinogenic risks and noncancer health hazards were evaluated by estimating the ELCR and HI for each of the sampling locations using the methodology outlined above. For each sample, the detected concentration of each metal was compared to the HPS-specific PRG. For metals that were not detected in a given sample, a value of one-half the detection limit was compared to the HPS-specific PRG.

5.0 REFERENCES

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- U.S. Department of Energy (DOE). 1984. "A Review and Analysis of Parameters Assessing Transport of Environmentally Released Radionuclides through Agriculture." Prepared by C.F. Baes, II, and Others. Oak Ridge National Laboratory. September.
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- EPA. 2002. "Region IX Preliminary Remediation Goals 2002." November.
- EPA. 2004. Integrated Risk Information System. Available Online at: <http://www.epa.gov/iris/index.html>.

FIGURES

Figure C-1
Estimated Cancer Risk, Innes Avenue Site

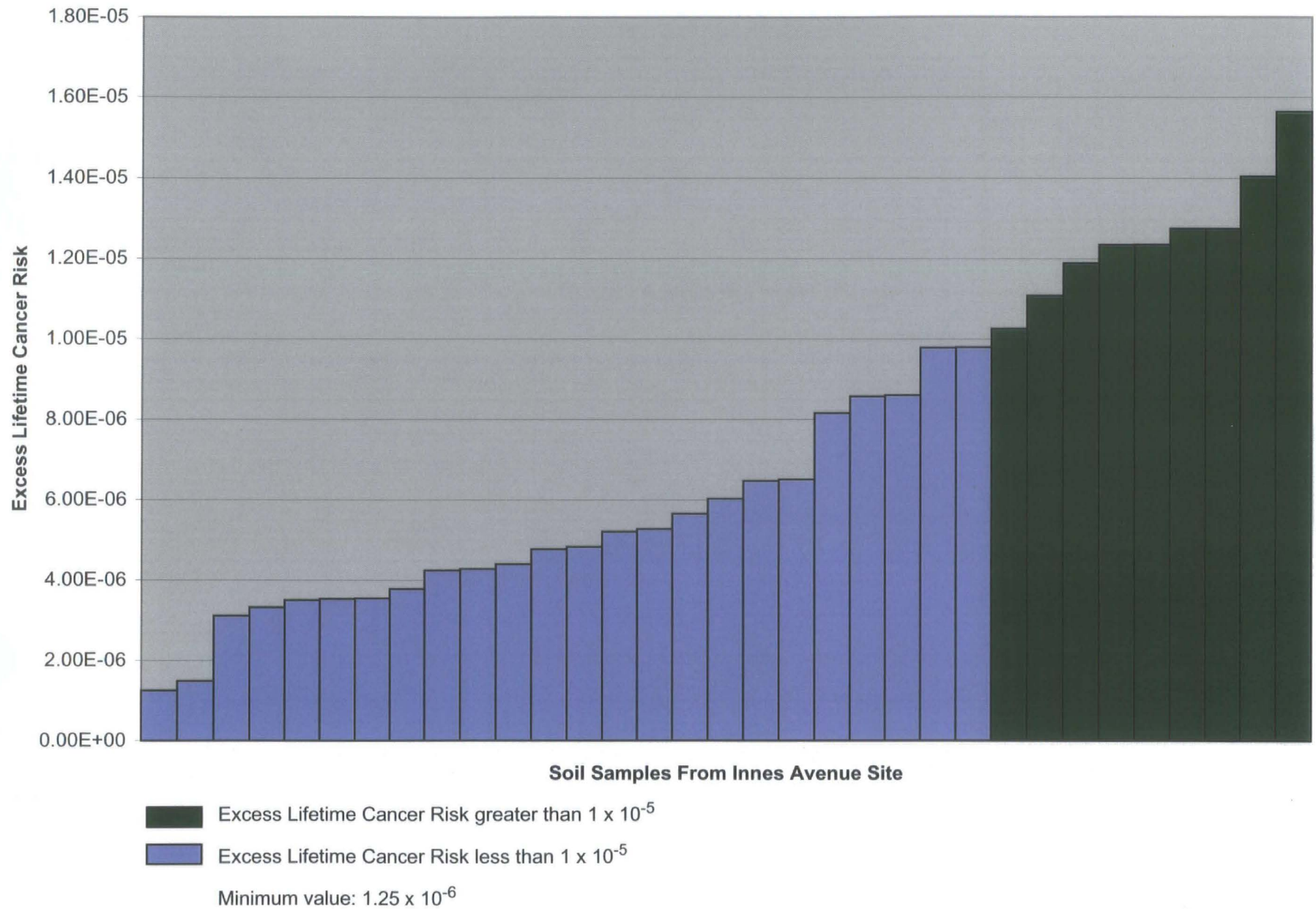
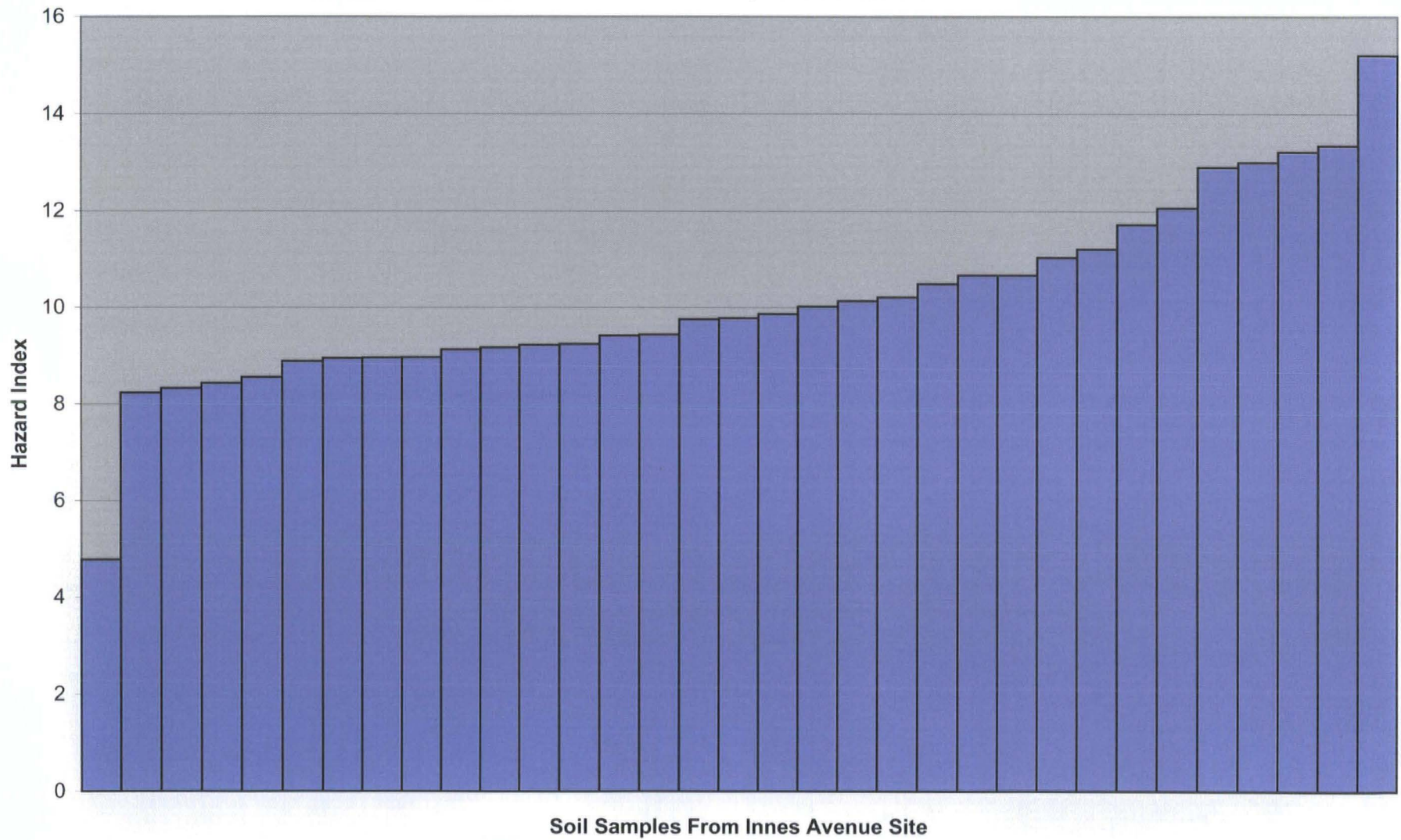
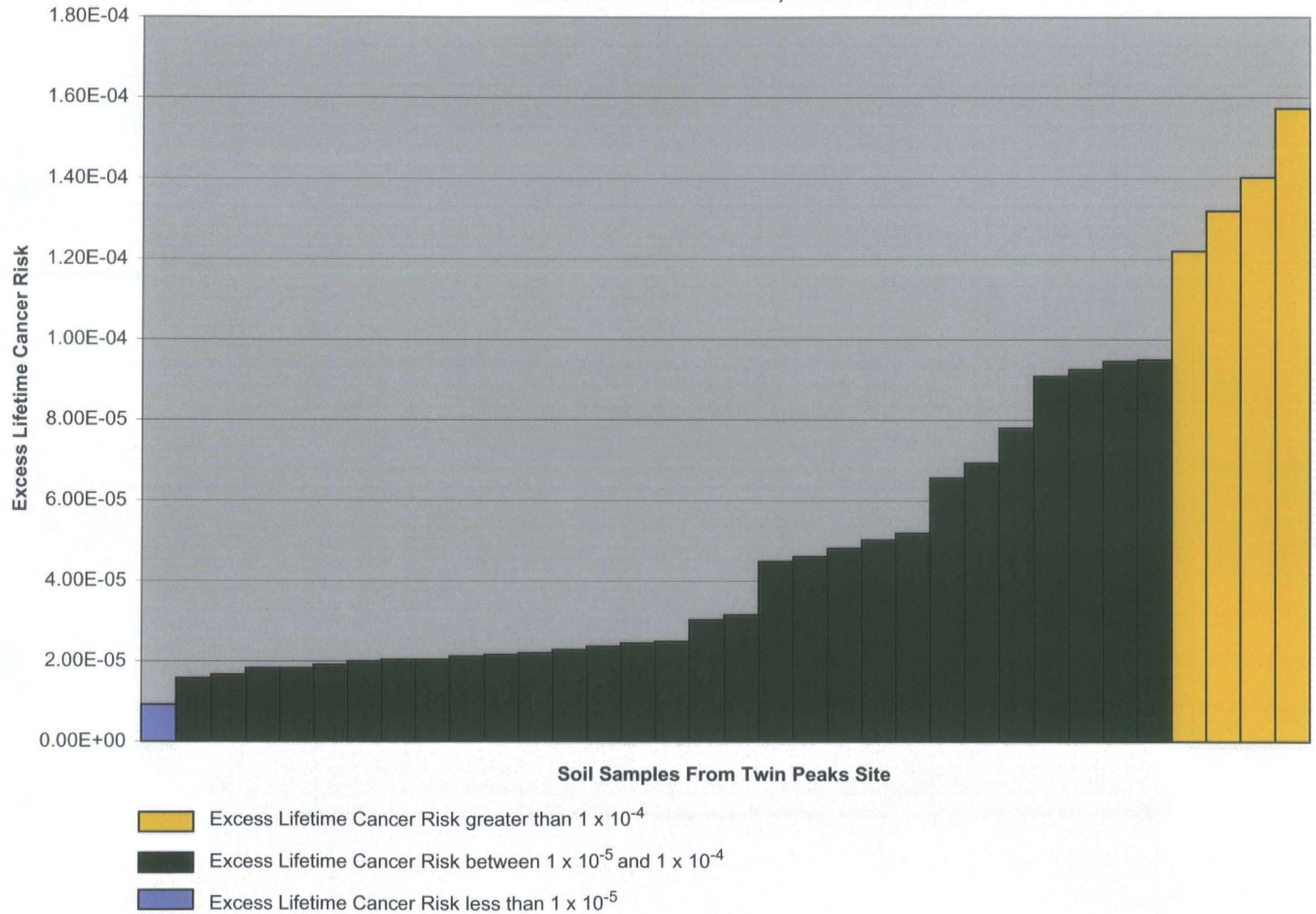


Figure C-2
Estimated Hazard Index, Innes Avenue Site



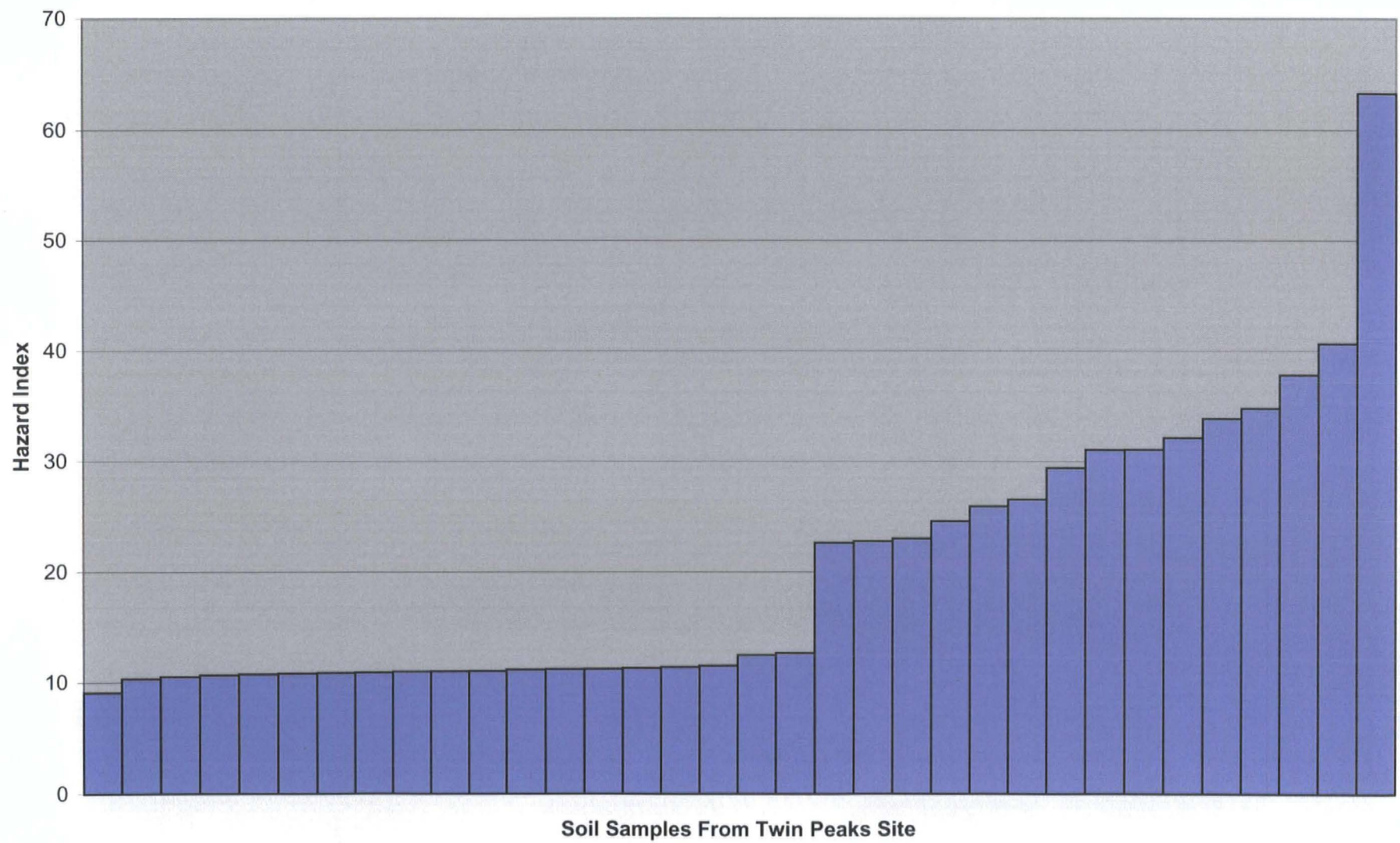
Minimum value: 4.8

Figure C-3
Estimated Cancer Risk, Twin Peaks Site



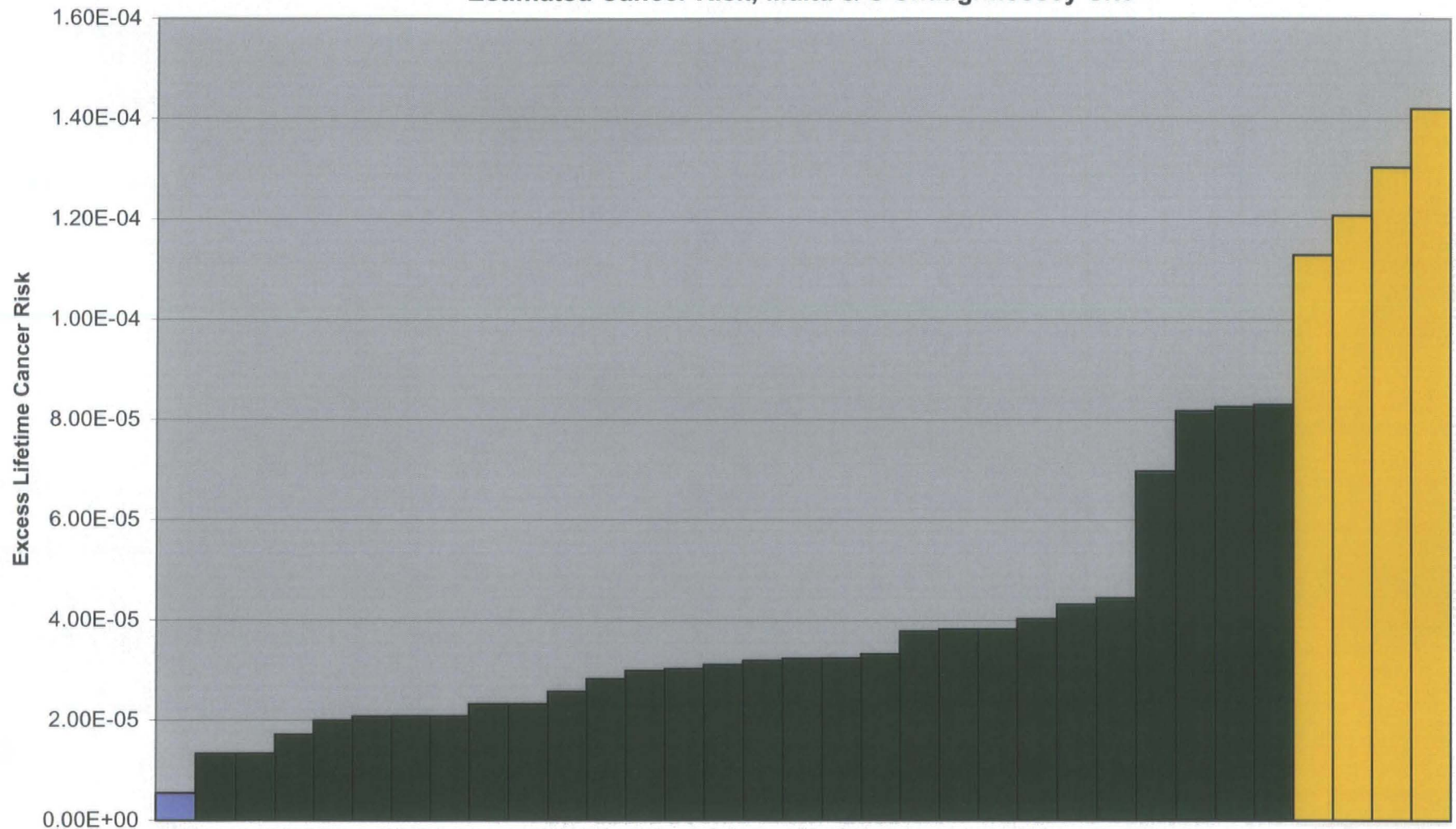
Minimum value: 9.1×10^{-6}

Figure C-4
Estimated Hazard Index, Twin Peaks Site



Minimum value: 9.1

Figure C-5
Estimated Cancer Risk, Malta & O'Shaughnessey Site

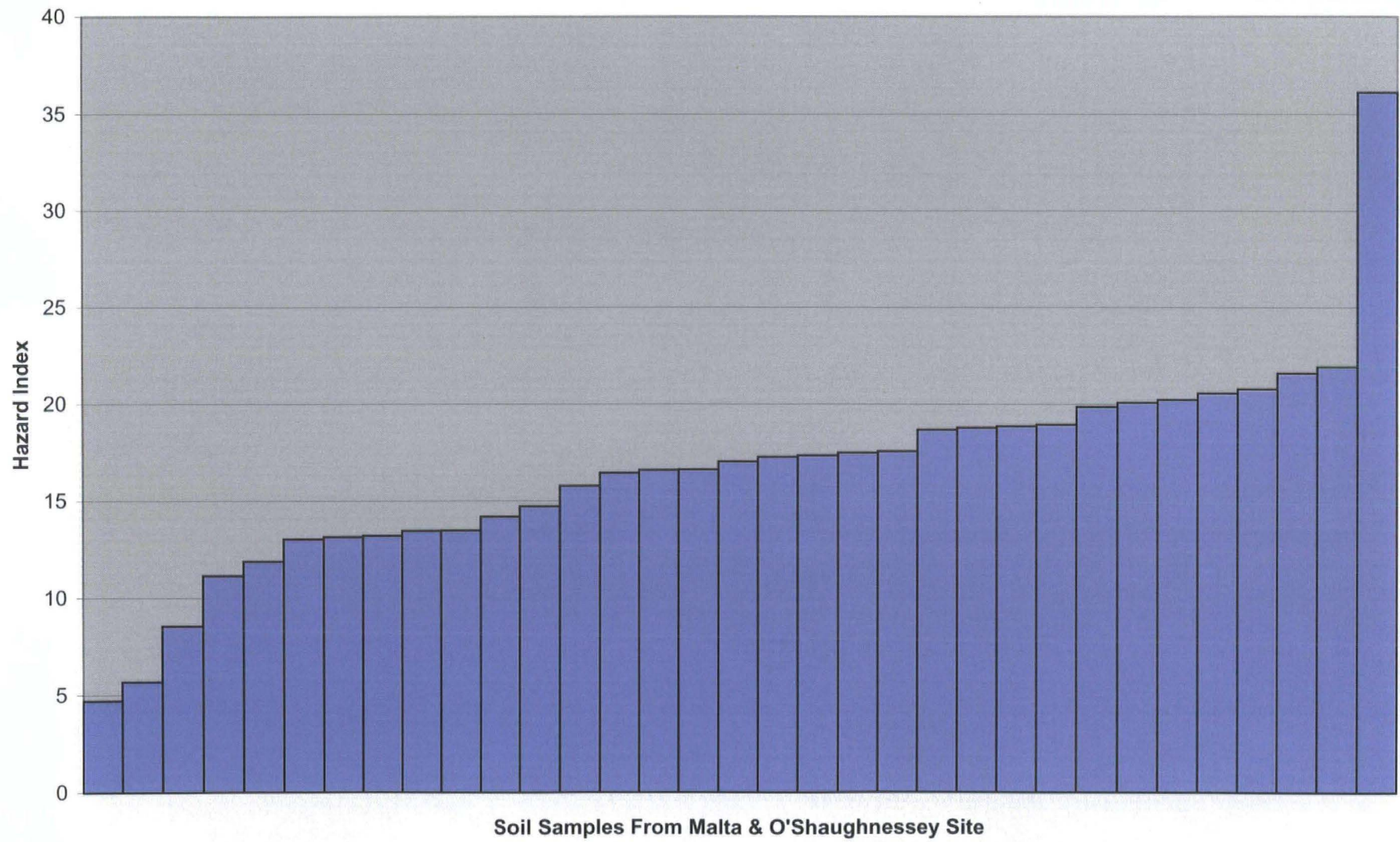


Soil Samples From Malta & O'Shaughnessey Site

- Excess Lifetime Cancer Risk greater than 1×10^{-4}
- Excess Lifetime Cancer Risk between 1×10^{-5} and 1×10^{-4}
- Excess Lifetime Cancer Risk less than 1×10^{-5}

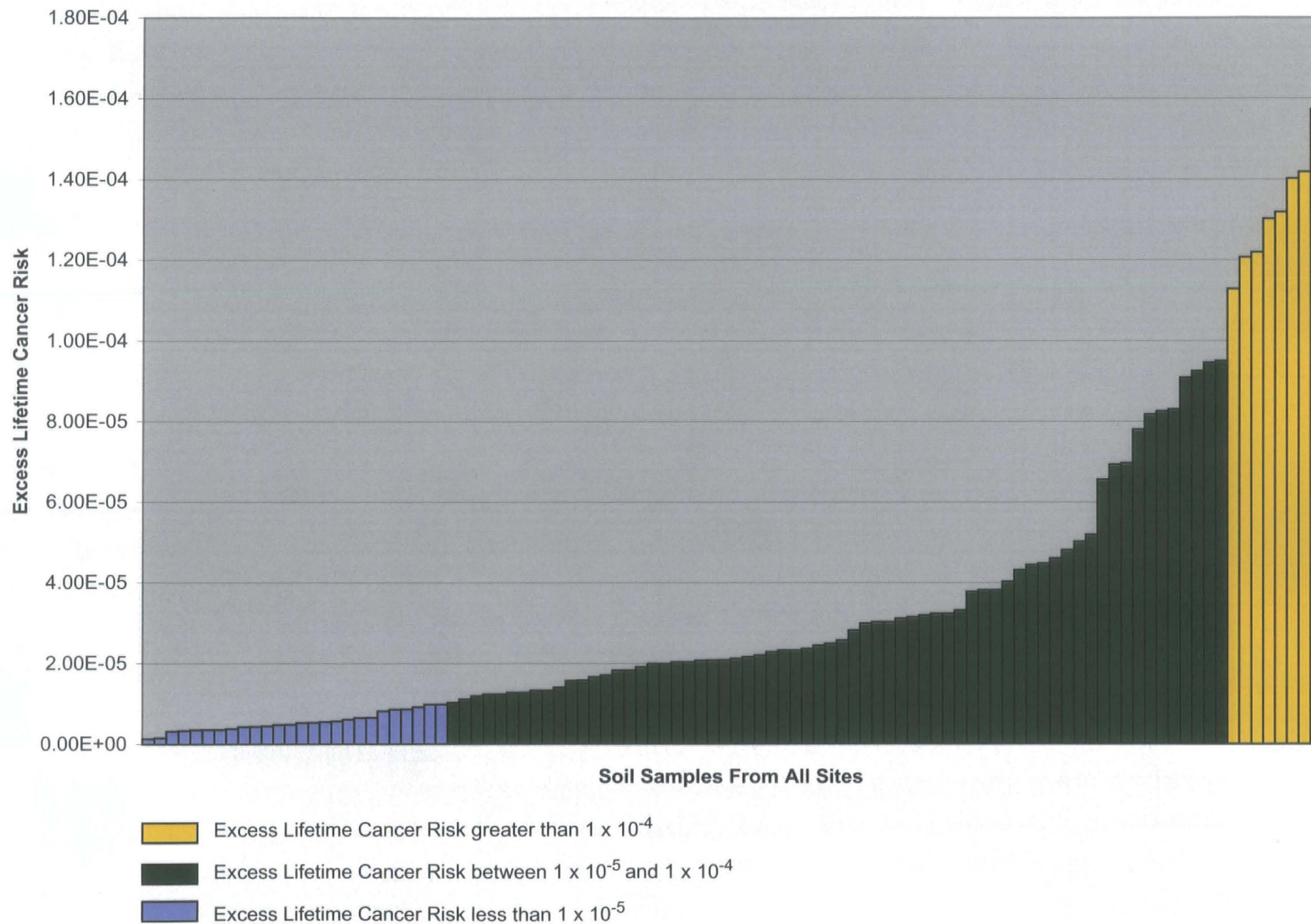
Minimum value: 5.45×10^{-6}

Figure C-6
Hazard Index, Malta & O'Shaughnessey Site



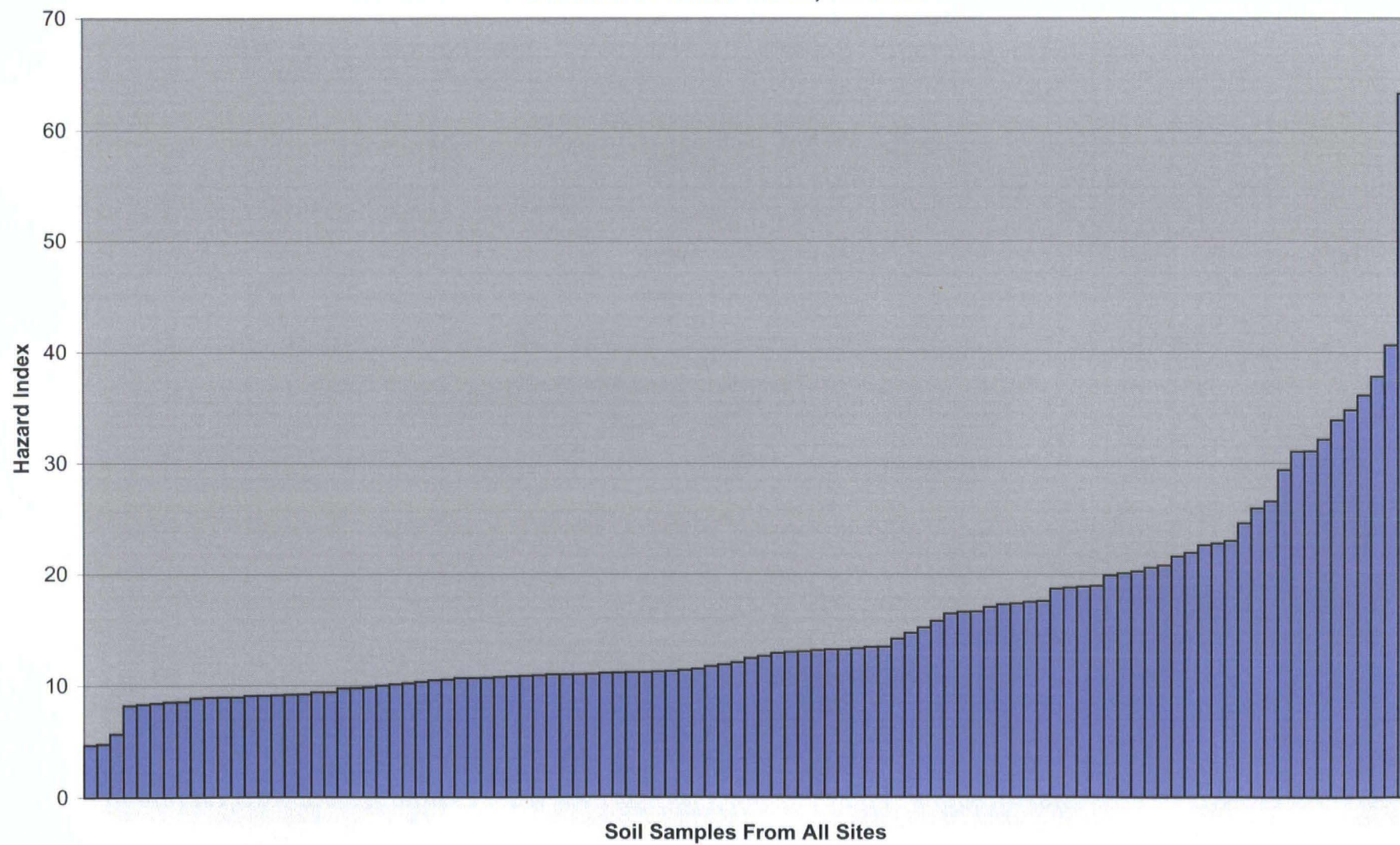
Minimum value: 4.7

Figure C-7
Estimated Cancer Risk, All Sites



Minimum value: 1.25×10^{-6}

Figure C-8
Estimated Hazard Index, All Sites



Minimum value: 4.7

TABLES

TABLE C-1: EXPOSURE PARAMETERS USED IN CALCULATING HPS-SPECIFIC PRGS

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Symbol	Definition (units)	Value	Reference
SF _o	Oral cancer slope factor (mg/kg-d) ⁻¹	Chemical-specific	EPA 2002, 2004; Cal/EPA 2004
SF _i	Inhalation cancer slope factor (mg/kg-d) ⁻¹	Chemical-specific	EPA 2002, 2004; Cal/EPA 2004
RfD _o	Oral reference dose (mg/kg-d)	Chemical-specific	EPA 2002, 2004; Cal/EPA 2004
RfD _i	Inhalation reference dose (mg/kg-d)	Chemical-specific	EPA 2002, 2004; Cal/EPA 2004
TR	Target cancer risk	1 × 10 ⁻⁶	--
THQ	Target hazard quotient	1	--
BW _a	Body weight, adult	70 kg	EPA 1989
BW _c	Body weight, child	15 kg	EPA 1991
AT _c	Averaging time, carcinogens	25,550 days	EPA 1989
AT _n	Averaging time, noncarcinogens	365 × ED	--
SA _a	Dermal surface area, adult (cm ² /d)	5,700	EPA 2001
SA _c	Dermal surface area, child (cm ² /d)	2,800	EPA 2001
AF _a	Soil adherence factor, adult (mg/cm ²)	0.07	EPA 2001
AF _c	Soil adherence factor, child (mg/cm ²)	0.2	EPA 2001
ABS	Skin absorption factor (unitless)	Chemical-specific	EPA 2001
IRA _a	Inhalation rate, adult (m ³ /d)	20	EPA 1991
IRA _c	Inhalation rate, child (m ³ /d)	10	EPA 1997
IRS _a	Soil ingestion rate, adult (mg/d)	100	EPA 1991
IRS _c	Soil ingestion rate, child (mg/d)	200	EPA 1991
IPR _a	Produce ingestion rate, adult (g/d)	122	EPA 1990, 1995
IPR _c	Produce ingestion rate, child (g/d)	79	EPA 1990, 1995
EF _r	Exposure frequency (d/y)	350	EPA 1991
ED _r	Exposure duration, resident (years)	30	EPA 1991
ED _c	Exposure duration, child (years)	6	EPA 1991
Age-adjusted factors for carcinogens:			
IFS _{adj}	Soil ingestion factor ([mg-y]/[kg-d])	114	EPA 2002
SFS _{adj}	Dermal factor ([mg-y]/[kg-d])	361	EPA 2002
InhF _{adj}	Inhalation factor ([m ³ -y]/[kg-d])	11	EPA 2002
Prod _{adj}	Produce factor ([g-y]/kg-d)	73	By analogy to EPA 2002
PEF	Particulate emission factor (m ³ /kg)	1.316 × 10 ⁹	EPA 1996
VF	Volatilization factor (m ³ /kg)	Chemical-specific	EPA 1996
UF	Produce uptake factor	Chemical-specific	DOE 1984

TABLE C-2: CHEMICAL-SPECIFIC VALUES USED IN CALCULATION OF HPS-SPECIFIC PRGS

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Metal	SFo (mg/kg-d)⁻¹	SFi (mg/kg-d)⁻¹	RfDo (mg/kg-d)	RfDi (mg/kg-d)	Uptake Factor (UF)	ABS (unitless)
Aluminum	--	--	1.0E+00	1.4E-03	1.1E-04	--
Antimony	--	--	4.0E-04	--	5.2E-03	--
Arsenic	1.5E+00	1.5E+01	3.0E-04	--	1.0E-03	0.03
Barium	--	--	7.0E-02	1.4E-04	2.6E-03	--
Beryllium	--	8.4E+00	2.0E-03	5.7E-06	2.6E-04	--
Cadmium	--	6.3E+00	5.0E-04	--	2.6E-02	0.001
Chromium III	--	--	1.5E+00	--	7.8E-04	--
Chromium VI	--	5.1E+02	3.0E-03	2.2E-06	7.8E-04	--
Cobalt	--	9.8E+00	2.0E-02	5.7E-06	1.2E-03	--
Copper	--	--	3.7E-02	--	4.4E-02	--
Iron	--	--	3.0E-01	--	1.7E-04	--
Manganese	--	--	2.4E-02	1.4E-05	8.7E-03	--
Mercury	--	--	3.0E-04	8.6E-05	3.5E-02	--
Molybdenum	--	--	5.0E-03	--	1.0E-02	--
Nickel	--	9.1E-01	2.0E-02	--	1.0E-02	--
Selenium	--	--	5.0E-03	--	4.4E-03	--
Silver	--	--	5.0E-03	--	1.7E-02	--
Thallium	--	--	6.6E-05	--	7.0E-05	--
Vanadium	--	--	7.0E-03	--	5.2E-04	--
Zinc	--	--	3.0E-01	--	1.6E-01	--

TABLE C-3: HPS-SPECIFIC PRGS

Metals Concentrations in Franciscan Bedrock Outcrops, Hunters Point Shipyard, San Francisco California

Metal	HPS-Specific PRG (mg/kg)	
	Cancer	Noncancer
Aluminum	--	7.3E+04
Antimony	--	1.0E+01
Arsenic	2.4E-01	1.6E+01
Barium	--	2.7E+03
Beryllium	1.1E+03	1.4E+02
Cadmium	1.4E+03	6.3E+00
Chromium	--	9.0E+04
Cobalt	9.0E+02	9.7E+02
Copper	--	1.6E+02
Iron	--	2.2E+04
Manganese	--	8.4E+02
Mercury	--	1.8E+05
Molybdenum	--	7.6E+01
Nickel	9.7E+03	3.1E+02
Selenium	--	1.4E+02
Silver	--	5.0E+01
Thallium	--	5.0E+00
Vanadium	--	4.5E+02
Zinc	--	3.7E+02

APPENDIX D
FIELD PHOTOGRAPHS

A photograph of a steep, rocky hillside. The hillside is covered with dark, jagged rock faces and patches of green and yellowish vegetation. A red string or tape is stretched across the middle of the rock face, forming a rectangular grid. At the base of the hill, there is a concrete curb and a paved road. On the left side of the curb, there are several white plastic containers, including two large buckets and a smaller jug. The text "RBSO1 Grid 1 Rock Grid" is overlaid in white on the upper part of the rock face.

RBSO1 Grid 1 Rock Grid

Innes Avenue Study Site

A photograph of a grassy, rocky hillside. The terrain is covered with dry, yellowish-brown grass and patches of green vegetation. Large, dark, jagged rocks are scattered across the slope. A study area is marked with several blue flags and a red string. The text "Western Side of Soil Grid" is overlaid in white at the top. The text "Ilmes Avenue Study Site" is overlaid in white at the bottom.

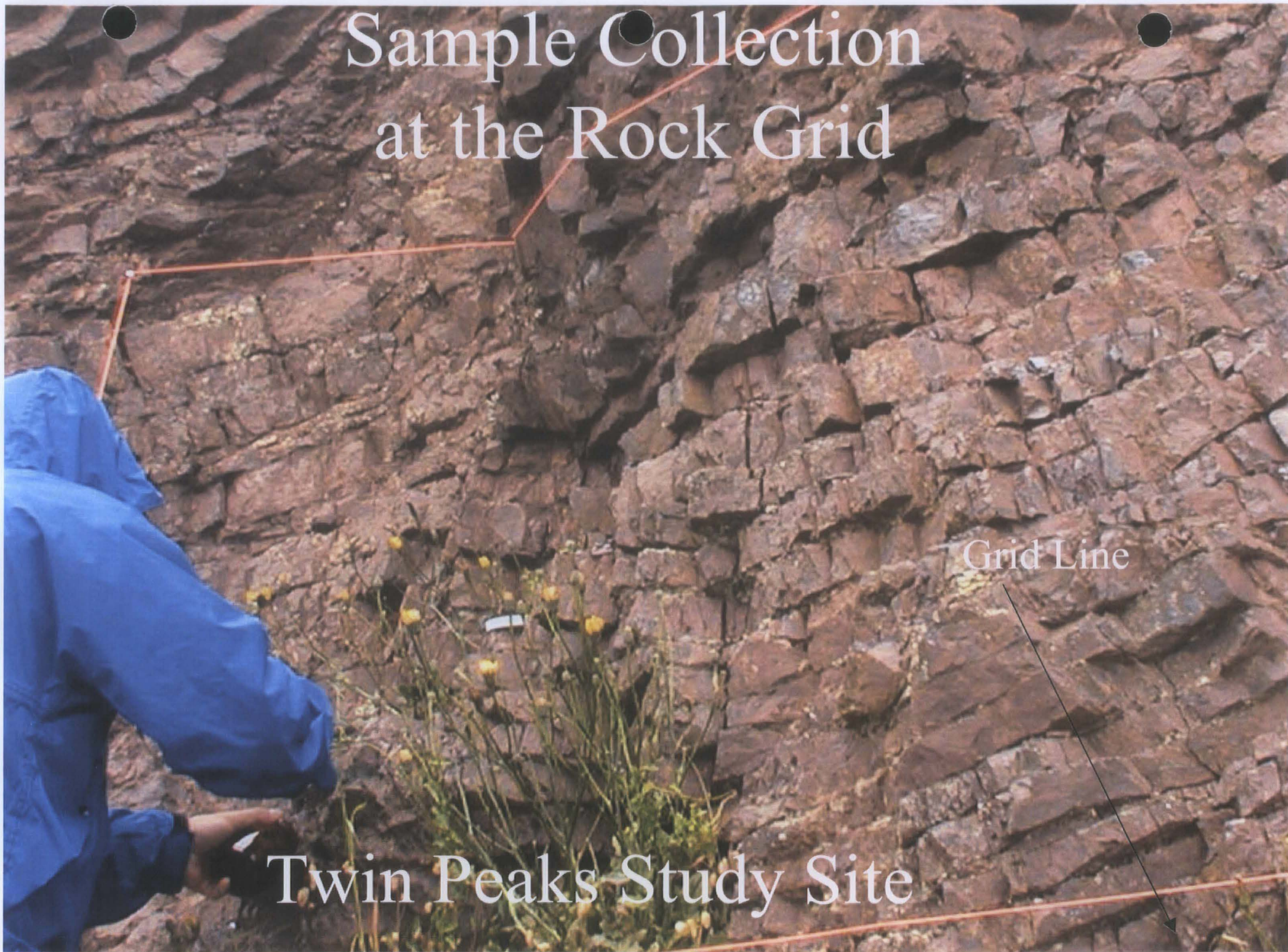
Western Side of Soil Grid

Ilmes Avenue Study Site

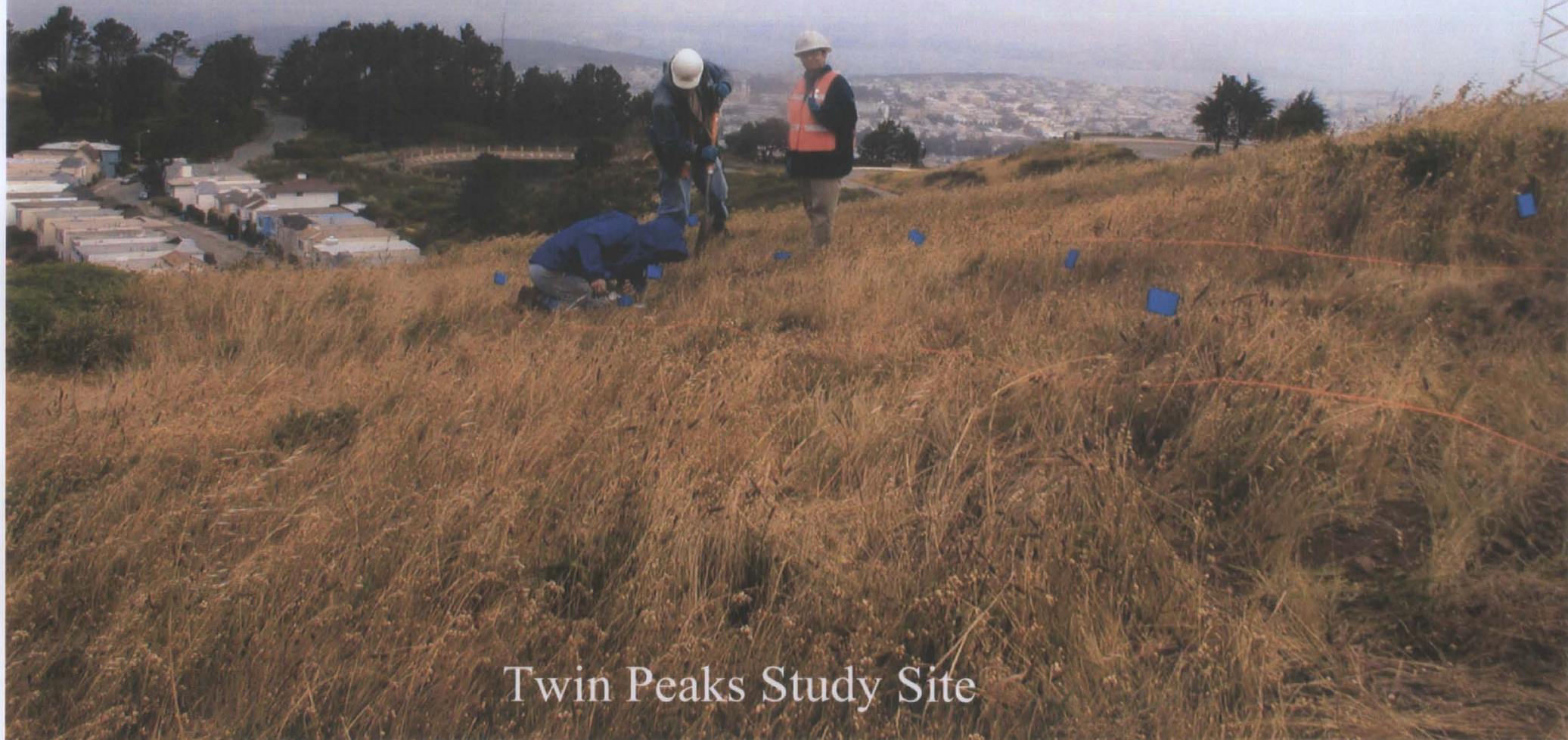
Sample Collection at the Rock Grid

Grid Line

Twin Peaks Study Site



Soil Grid at Top of North Peak



Twin Peaks Study Site



RBS03 Grid 1 Rock Grid

Malta Drive Study Site



RBS03 Soil Grid Setup

Malta Drive Study Site

**APPENDIX K
RESPONSES TO REGULATORY AGENCY COMMENTS ON THE DRAFT PARCEL B
TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION
AMENDMENT**

This appendix also contains comments received from the U.S. Environmental Protection Agency (EPA), the Department of Toxic Substances Control (DTSC), and the City of San Francisco on the responses to comments. Comments were submitted by Michael Work (EPA) on January 12, 2007, by Thomas P. Lanphar (DTSC) on March 6, 2007, and by Amy Brownell (City of San Francisco) on January 9, 2007. The draft final TMSRA has been revised to the extent possible to address these additional comments; however, responses to these comments are not provided.

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the U.S. Environmental Protection Agency (EPA) on the “Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated March 28, 2006. Comments were submitted by Michael Work (EPA) on June 15, 2006. Throughout this table, *italicized* text represents proposed additions to the TMSRA and ~~strikeout~~ text indicates locations of proposed deletions. These responses were submitted on December 8, 2006 and discussed with EPA during meetings on January 9 and 23, 2007. Additional information related to a response as a result of further discussions is identified in this table as “**Follow-up**” at the end of a response. EPA provided comments on the responses in this table in a letter dated January 12, 2007. These additional EPA comments are provided in a separate attachment. Throughout this table, references to page, section, table, and figure numbers pertain to the draft TMSRA, even though some of these numbers have changed in the draft final TMSRA.

No.	Page	Comment	Response
General Comments			
1.	---	The Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment (TMSRA), a document written to support the need for a ROD amendment, does not make the case clearly and transparently that the currently approved remedy is no longer workable. Indeed, this document is silent on what are the major reasons why we are proceeding toward a ROD amendment, i.e., reasons related to either cost or implementability. If the currently approved remedy cannot be implemented due to irresolvable technological or engineering problems, then this TMSRA needs to fully explain and document that problem. If it is more of an issue related to cost rather than implementability, then this TMSRA needs to provide that demonstration.	<ul style="list-style-type: none"> The text of the first paragraph of Section 1.1 on page 1-2 will be revised as follows to further explain the need for a ROD amendment. Similar text will be added to the executive summary (see Attachment 1). <p>“Table 1-1 summarizes the CERCLA-related activities conducted at Parcel B. Parcel B has completed the steps through post-construction reporting (including the five-year review); however, updated information about the site that became available during the remedial action indicates that modifications to the selected soil and groundwater remedies should be considered. <i>The five-year review (Tetra Tech 2003b) concluded that the remedy selected in the ROD (Navy 1997) needs to be modified to be protective in the long term. The BCT has extended the schedule of CERCLA activities (contained in the FFA) to evaluate potential modifications to the Parcel B remedy and support the preparation of this TMSRA.</i></p> <p><i>A ROD amendment will be proposed for Parcel B by the Navy if the Navy determines that proposed changes to the selected remedy based upon the evaluations in the TMSRA will “fundamentally alter the basic features of the selected remedy with respect to scope, performance, or cost” as described in the NCP at 40 CFR 300.435(c)(2)(ii). For example, the consideration of parcel-wide covers to address soil contamination instead of excavation may represent a fundamental change in the scope of the remedy. For groundwater, addition of active groundwater treatment methodologies to the remedy may be a fundamental change in the scope.</i></p> <p>The updated information about the ubiquitous nature of certain chemicals <i>metals</i></p>

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
			<p>in soil, the presence of methane and radiological contamination, the need to update certain cleanup levels, and the more comprehensive understanding of groundwater, together with the currently planned land use, indicate the need to revise the conceptual site model, evaluate support additional remedial actions, and evaluate amending the ROD. This TMSRA provides the support for the decisions regarding remediation alternatives in an updated proposed plan and ROD amendment that will come later, in the same way that the FS supported the initial proposed plan and ROD. The TMSRA provides a practical path forward to evaluate-undertake additional remedial actions that will support parcel transfer.</p> <p>The discovery of demolition debris fill at IR-07 and IR-18 as well as a small area where methane was detected in soil gas at IR-07 created a need to revise the conceptual site model. The discovery of radiological contamination in soil at Parcel B also affects the conceptual site model. The original conceptual site model does not address the debris fill, methane, or radiological contamination and, consequently, the excavation and off-site disposal remedy selected for soil in the ROD will not be protective in the long term. The increased understanding of groundwater, including the results of groundwater monitoring and treatability studies, has allowed for a more focused evaluation of potential groundwater remedies than was possible in the ROD. In addition, the groundwater remedy needs to be expanded to account for the increased potential risk from VOCs and mercury in groundwater and provide remediation alternatives to address this risk. Updated cleanup levels for VOCs in the vapor phase need to be addressed by evaluating additional remedial alternatives. This TMSRA provides the support for the decisions that will be made in an updated proposed plan and ROD amendment that will come later, in the same way that the FS supported the initial proposed plan and ROD.</p> <p>The current remedy is evaluated in light of this updated site information and new remediation alternatives are proposed in this TMSRA. Both the current and proposed remediation alternatives are evaluated addressing the nine criteria described in the NCP at 40 CFR 300.430(e)(9)(iii) later in Section 6.0 of this document. Implementability and cost are reviewed in that analysis as provided by the NCP. Upon completion of the revised detailed evaluation of remedial alternatives, the Navy will comply with the requirements of the NCP at 40 CFR 300.435(c)(2) in making a formal determination concerning a ROD amendment. The proposed decision to amend the ROD will be addressed in the proposed plan that will follow the TMSRA. The following section describes the need to amend</p>

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
			<p><i>the ROD in more detail.”</i></p> <p>Follow-up: The last two paragraphs of this response were not added to Section 1.1, but similar text was incorporated into new Section 1.2. In addition, the executive summary and Section 1.2 were expanded to note that VOC concentrations at IR-10 were found to be an order of magnitude higher than was known when the ROD was prepared. Section 1.2 was also expanded to state that the actual remedial action cost was more than 3.5 times the cost estimated in the ROD.</p> <ul style="list-style-type: none"> The proposed new Section 1.2 is provided as Attachment 1 to this response to comments document. Attachment 1 also contains new Section 6.5, which evaluates the current ROD remedy against the NCP criteria. Section 6.5 will complement the existing sections that evaluate the newly developed remediation alternatives proposed in the TMSRA against the NCP criteria.
2.	---	<p>EPA was disappointed that the new array of alternatives are mostly based on preventing complete pathways and do not propose significant effort to conduct further cleanup which might result in an expansion of the area(s) not required to maintain cover. We cannot help but imagine some alternative which considers the achievement of industrial cleanup levels for more of the parcel with some effort to negotiate advantageous spatial extent of reuse areas with the reuse authorities.</p>	<ul style="list-style-type: none"> Remediation alternatives in the TMSRA were selected to support the planned reuse of Parcel B, most of which will be subject to residential, not industrial, exposure conditions. Arsenic, even at concentrations below the Hunters Point ambient level (HPAL), represents an excess lifetime cancer risk greater than 10^{-6}. The Navy proposes to use covers over all redevelopment blocks (informally termed “full lot coverage”) and institutional controls to address potential risks caused by ubiquitous metals and debris fill at IR-07 and IR-18. Since the major risk driver is arsenic, and its occurrence is parcel-wide, the exposure pathway must be broken. The Navy is still committed to removing spills and releases where practical. For example, excavation of mercury at IR-26 will be considered in the draft final TMSRA.
3.	---	<p>It is not clear from the Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment, dated March 2006 (the TMSRA) why the potential for hydraulic communication was not considered for the three Risk Plumes identified in Attachment A4 of the Human Health Risk Assessment (HHRA).</p> <p>The fourth and fifth paragraphs of Section A4.3 indicate that during the HHRA the potential for hydraulic communication between the A and B Aquifers was only evaluated for small areas of the western portion of Parcel B, and that none of the groundwater plumes (IR-10A, IR-10B and IR-25) were assumed to be in communication with the B-Aquifer. This</p>	<ul style="list-style-type: none"> The basis for the groundwater risk evaluations in the HHRA is data from groundwater samples. Aquifer test data to evaluate potential communication between aquifers are not available. Only two monitoring wells exist in the B-aquifer at Parcel B and the HHRA evaluated risks for domestic use of groundwater based on the 12 most recent quarters of sampling data from those wells. The HHRA concluded that arsenic in groundwater at one well in the B-aquifer posed a potential unacceptable risk; however, that risk was caused by concentrations below the Hunters Point groundwater ambient level (HGAL) for arsenic. Therefore, the potential risk results from naturally occurring conditions in the B-aquifer. Any communication between the A and B aquifers is assumed

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
		<p>interpretation should be supported by pump test results that show no communication between the aquifers at the groundwater plume locations before the potential for hydraulic communication can be dismissed from the Site Conceptual Model.</p> <ul style="list-style-type: none"> According to Figure 5 of the Technical Memorandum for the Distribution of the Bay Mud Aquitard and Characterization of the B-Aquifer (the B-Aquifer Tech Memo), the A-Aquifer appears to be in contact with the B-Aquifer (i.e., the Bay Mud Aquitard is absent) in the western portion of IR-10 and at Building 134 in Parcel C (adjacent to the parcel boundary). This stratigraphic relationship appears to suggest that the two aquifers are predominantly in communication in the area of the IR-10A and IR-10B Risk Plumes, and in the area with the highest concentrations of Volatile Organic Compounds (VOCs) in the IR-25 Risk Plume. 	<p>to be negligible and B aquifer monitoring could be included in remedial design to confirm this.</p> <ul style="list-style-type: none"> The groundwater evaluation for domestic use in the HHRA made a further conservative (protective) assumption to consider the possibility of groundwater from the A-aquifer being drawn downward into the B-aquifer by domestic wells screened in the B-aquifer at locations where the potential exists for the A- and B-aquifers to be in hydraulic communication. In these cases, data for groundwater from both aquifers were combined for the risk evaluation. This situation occurred in two locations at Parcel B and the HHRA concluded that potential unacceptable risk related to domestic use was posed, based on the A-aquifer data, in both cases. Follow-up: No remediation or groundwater monitoring is proposed for the B-aquifer because the only potential risk (from arsenic) is based on naturally occurring conditions. The Navy does not propose to remediate groundwater in the A-aquifer based on the potential for migration into the B-aquifer.
		<p>Please revise the text and tables of Attachment A4 to address the potential for hydraulic communication at each of the groundwater plumes, or present aquifer pump test results to support the interpretation that none of the plumes are in communication with the B-aquifer at the following wells:</p> <ul style="list-style-type: none"> IR-10A Plume: IR10MW32A, IR10MW33A, IR10MW59A, IR10MW61A, IR10MW62A, IR10MW69A, IR10MW71A, IR10MW75A and IR10MW76A; IR-10 B Plume: IR10MW12A and IR61MW05A; IR-25 Plume: IR06MW44A, IR25MW11A, IR25MW15A1, IR25MW15A2, IR25MW15F, IR25MW16A, IR25MW18A, IR25MW19A, IR25MW20A, IR25MW39A, IR25MW42B, IR25MW51A, IR25MW900B, IR25MW901B, IR25MW902B, IR25MW903B, IR25MW904B, IR25MW905B. 	<ul style="list-style-type: none"> No other groundwater data exist for the B-aquifer at Parcel B. The only evaluation available for other areas (such as IR-10 or IR-25) where the A- and B-aquifers may be in communication would be an evaluation of the domestic use of groundwater based on the data collected solely from the A-aquifer. However, groundwater in the A-aquifer is recognized as not being of suitable quality for use as a drinking water source (see Water Board 2003 letter in Appendix G), so quantitative evaluation of its use for drinking water would be of limited value. Evaluation of groundwater from the A-aquifer for domestic use would likely indicate the same areas of potential unacceptable risk already presented for vapor intrusion on Figure 3-8. However, the uncertainty analysis in the HHRA (Section A9.0) will be expanded to discuss potential risks from domestic use of groundwater from the B-aquifer where it may be in communication with the A-aquifer, including IR-10 and IR-25. This discussion will include a quantitative estimate of the potential risks from domestic use of the A-aquifer in these areas. Potential risks will be estimated ratiometrically, using maximum chemical concentrations measured in the A-aquifer groundwater for the areas of potential communication at IR-10 and IR-25 and EPA (2004a) tap water preliminary remediation goals. Reference to this discussion will also be added to Section 3.1.4, Risk Summary for Groundwater.

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
			<ul style="list-style-type: none"> Quantitative data, such as aquifer pumping tests, are not available to evaluate the degree of hydraulic communication between the A- and B-aquifers. However, the HHRA in the TMSRA takes the conservative (protective) approach and calculates the risk as though communication exists in locations where the aquifers are adjacent. Collection of additional data to quantify the degree of communication would not alter the results of the risk evaluation. However, groundwater monitoring in the B-aquifer may be considered during the remedial design phase.
4.	---	<p>Most of the figures of the TMSRA do not include Installation Restoration (IR) Site boundaries as requested by the Regulatory Agencies; therefore, previous investigations and remedial actions, historically categorized by IR Sites, cannot be easily compared to the data used for the Redevelopment Blocks. For example, the TMSRA has proposed Remedial Action Objectives (RAOs) and recommended selected remedies and for the Redevelopment Blocks, but these RAOs and remedies need to be compared with the RAOs and selected remedies that were agreed upon in the Parcel B Record of Decision (the ROD). Please include IR Site boundaries on all figures that depict the boundaries of Redevelopment Blocks.</p>	<ul style="list-style-type: none"> IR site boundaries at Parcel B are intricate and add significant complexity to any figure, especially figures showing the entire parcel. IR site boundaries will be added to Figures 3-11 through 3-25 that show individual redevelopment blocks and to Figure 2-7 showing general groundwater plume locations. However, adding IR site boundaries to other figures illustrating the entire parcel will seriously detract from the ability of those figures to convey the intended information. Figure 1-3 provides the locations of IR site boundaries at the same scale as most of the other figures in the TMSRA. A clear overlay based on Figure 1-3 showing the IR site boundaries will be provided that readers can use to identify IR site boundaries on other figures displaying the entire parcel.
5.	---	<p>The text of the TMSRA refers to ubiquitous metals in several places and states that arsenic, antimony, cadmium, copper, manganese, vanadium, and zinc are believed to be naturally occurring, but it is not appropriate to conclude that metals above the Hunters Point Ambient Levels (HPALs) are naturally occurring. The HPALs were developed to distinguish between ambient levels of metals which exist due to the origins of the fill material and concentrations of metals which appear to be due to site activities. Indeed, there is also disagreement as to whether any of the fill can be considered naturally occurring since it was placed in the Bay to increase the footprint of the Shipyard. Please revise the TMSRA to use terminology acceptable to the BCT [Base Realignment and Closure Cleanup Team].</p>	<ul style="list-style-type: none"> The Navy does not agree with EPA's description of HPALs. Although HPALs are useful to help distinguish between naturally occurring and manmade concentrations of metals in soil, the HPAL values do not represent a discrete dividing line. Each HPAL was derived using statistical methods from a distribution of concentrations based on samples collected throughout HPS. The statistical methods used to evaluate the data were selected in close coordination with scientists from EPA and the California Department of Toxic Substances Control (DTSC). The concept of a statistical distribution describing a population of data is central to HPALs because the HPAL value is a single number that attempts to represent an entire population. In statistical terms, the HPAL is a 95th percentile upper confidence limit (95 UCL), so by definition, a portion of the naturally occurring data set will be above the HPAL. The natural distribution of metals concentrations at Parcel B will contain many values above the HPAL based simply on the heterogeneity of the native rock at HPS. When an HPAL is used as a ROD cleanup goal, it is a discrete criterion, but this is not based on the nature of the HPAL nor is it consistent with the method used to select HPALs.

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			<ul style="list-style-type: none"> Follow-up: EPA's position on HPALs differs from the Navy's position. The following is EPA's position based on information submitted via email on April 18, 2007. <p>Defined in statistical terms, the HPAL is the 95th percentile of a selected ambient data set. However, because of the mineralogy of serpentinite, for chromium, cobalt and nickel, the HPALs are calculated from regression equations based on a comparison to magnesium concentrations. HPALs do not represent "clean" (that is, naturally occurring) or "contaminated" levels because it was not possible to exclude all potentially contaminated samples included from the HPAL data set. In order to minimize the inclusion of contaminated samples, data from known landfills or fill areas IR-01, IR-02, and IR-03, and from the pickling and plate yard, IR-09, were excluded from the HPALs data set. Similarly, data from the surface to 5 feet below ground surface were excluded from the data set used to calculate the HPALs to minimize the potential impact from surface releases of metals. Outliers were also excluded after examining plots for each metal. It is now recognized that anthropogenic sources of metals contamination (for example, from contaminated fill) and site activities impacted soil at other sites (for example, IR-07, IR-10, IR-18, and IR-26 in Parcel B). By definition, the data set then includes locations with naturally occurring and anthropogenic metals concentrations (including releases from site activities).</p> <p>Therefore, it is incorrect to refer to the HPALs as representative of naturally occurring background concentrations, which is why they are considered "ambient" levels. Since a true background concentration cannot be determined, the HPALs can be used as screening criteria to evaluate the level of effort and as cleanup goals. Historically, HPALs have been used as screening criteria along with the specific concentrations, exposure pathways, and estimated volumes to evaluate whether removal or remediation of soil with concentrations above the HPALs is necessary.</p>

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			<ul style="list-style-type: none"> • The Navy believes that the practice of using quarried local rock for fill at HPS is similar to construction practices in the same bedrock formations used elsewhere in San Francisco. The Navy observed that a wide range of concentrations of metals are found in similar chert, basalt, and serpentinite bedrock formations in other areas of San Francisco based on sampling that the Navy conducted in 2003 at areas outside of HPS. This information is summarized in a report titled <i>Metals Concentrations in Franciscan Bedrock Outcrops</i> (Tetra Tech and ITS1 2004). This report will be attached as Appendix J to the draft final TMSRA and briefly summarized in the following paragraph that will be added to Section 2.1.2 (History of Investigations). • “Metals Concentrations in Franciscan Bedrock Outcrops Study. The Navy studied the ambient concentrations of metals in bedrock and bedrock-derived soil from three nonindustrial sites in San Francisco. These three sites have a similar geologic setting to HPS and contain serpentinite or chert and basalt bedrock typical of the Franciscan Complex. The sites included two Franciscan Complex subunits: the Hunters Point Shear Zone and the Marin Headlands Terrane. The investigation included about 30 rock and soil samples from each of the three sites (91 samples total) that were analyzed for metals using a standard analytical suite of EPA methods. The study found elevated concentrations of arsenic, iron, and manganese associated with chert bedrock and elevated nickel concentrations associated with serpentinite. The chemical composition of soil at the three sites was found to be similar to the chemical composition of rock. Of the 91 samples collected, none met the cleanup standards for unrestricted residential reuse at HPS. Appendix J contains the report from this investigation.” • The text proposed for addition to the executive summary and new Section 1.2 (see EPA general comment 1) will help clarify the Navy’s position (see Attachment 1). In addition, the text in Section 2.3.1 (partial paragraph at the top of page 2-18) will be modified to include the following. “The same condition is true for a group of metals...and zinc. <i>The Navy acknowledges that industrial sources for metals exist and that there is a potential that some concentrations of metals could have sources other than naturally occurring rock. The Navy has worked to remove these sources during the remedial actions taken to date. However, the widespread distribution of metals remaining in soil is consistent with the concentrations present in native rock. Remedial alternatives in this TMSRA will be designed to be protective of risks from these metals concentrations, regardless of source.</i> Section 3.0 and...”

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			<ul style="list-style-type: none"> • Follow-up: The following clarification of the term “ubiquitous” was added to the executive summary, Section 1.2 (need for reevaluation of current remedy) and Section 2.3 (updated characterization of soil and groundwater). “In the TMSRA, the term “ubiquitous” refers to metals that are naturally occurring or are in the same concentration ranges as naturally occurring metals in the source material (including material from the same geologic formations in the San Francisco area) that was used for filling operations at HPS. The Navy acknowledges that industrial sources of metals exist at HPS and that there is a potential that some concentrations of metals could have sources other than naturally occurring materials. The Navy has worked to remove these sources during the remedial actions taken to date.”
6.	---	<p>The Technical Memorandum in Support of a Record of Decision Amendment (TMSRA) did not identify ARARs for radionuclides. In Section 2.1.2 of the TMSRA, the Navy states that “[t]he Navy continues to investigate and clean up radiologically impacted areas throughout the [Hunters Point Shipyard (HPS)], including some at Parcel B. . . . Potential remedial actions in the TMSRA that would involve excavation and disposal account for screening for radiological contamination in the areas identified as impacted.” In Section 2.1.5.4 of the TMSRA, the Navy states that “[r]adiological issues will be addressed in a future radiological addendum to the TMSRA.” Federal and state requirements and other guidance do exist that may constitute ARARs or TBC criteria for radionuclides. These requirements should be considered by the Navy prior to the implementation of response actions at HPS Parcel B.</p>	<ul style="list-style-type: none"> • Federal and state requirements that may be considered as applicable or relevant and appropriate requirements (ARAR) will be identified and discussed in the radiological addendum to the TMSRA. Both the TMSRA and the radiological addendum will support the ROD amendment and all ARARs, including those pertaining to radionuclides, will be identified in the ROD amendment. No change to the report is proposed from this comment.

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7.	---	The TMSRA does not consider whether United States Department of Transportation and California Department of Transportation regulations are ARARs for off-site remedial actions. These federal requirements at 40 CFR Part 263 and state requirements would apply to the off-site transportation of hazardous materials. These transportation requirements are incorporated by reference into California's RCRA regulations at 22 CCR and the California Health and Safety Code, Sections 25167.1 through 25169.3. Please consider discussing whether these requirements are "applicable" or "relevant and appropriate" ARARs for remedial actions that involve the transporting of hazardous materials off-site. In addition, placement of soil on land would trigger federal restrictions closure requirements at 40 CFR 264.110 through 264.120 for units that store hazardous waste for more than 90 days. Please consider discussing whether these requirements are "applicable" or "relevant and appropriate" ARARs for remedial actions that involve transporting hazardous materials off-site.	<ul style="list-style-type: none"> Section 121(e) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA § 121[e]) states that ARARs apply to remedial actions conducted entirely on site. The off-site disposal of excavated soil or other waste generated in the performance of various alternatives is not an on-site remedial action. Therefore, the Navy has not identified any ARARs for off-site disposal; including requirements at Title 40 Code of Federal Regulations (40 CFR) Part 263 (requirements applicable to transporters), California Health and Safety Code §§ 25167.1 through 25169.3 (requirements applicable to hazardous waste haulers) and 40 CFR §§ 264.110 through 264.120 (requirements applicable to hazardous waste facilities). Should the Navy dispose of excavated soil or other waste generated in the performance of the various alternatives off site, the Navy will comply with all legally applicable transportation and disposal requirements. In addition, the Navy will use Resource Conservation and Recovery Act (RCRA)-licensed transporters and RCRA-licensed disposal facilities, both of which will be responsible for complying with the identified regulations. No change to the report is proposed from this comment.
8.	---	It is stated that based on updated site information, a Screening-Level Ecological Risk Assessment (SLERA) was conducted for Parcel B focusing on groundwater and sediment media. It is not clear from the text if a SLERA was conducted for soil media, or if past investigations and activities at the site (e.g., soil removal), were protective of ecological resources. Please revise the TMSRA to include this information and to verify that a SLERA is not necessary for soil media at Parcel B.	<ul style="list-style-type: none"> The ROD (Section 2.6.2) concluded that Parcel B does not pose a risk to terrestrial receptors; Section 3.2 of the TMSRA reiterates this information. Consequently, a SLERA is not necessary for soil at Parcel B and none was conducted. No change to the report is proposed from this comment.
9.	---	It appears that risk-based concentrations (RBCs), based on the outcome of the SLERA, are provided in Table 3-20. However, no information is contained in the TMSRA to explain how these final values were derived. Please revise the document to clarify how the RBCs were derived.	<ul style="list-style-type: none"> Risk-based concentrations were based on the methodologies used in the SLERA. Risk-based concentrations for copper, lead, zinc, total aroclors, total dichlorodiphenyltrichloroethane (DDT), and dieldrin, were based on the effects range-median (ER-M) values (Long and others 1995). The risk-based concentration for dibenz(a,h)anthracene was based on the San Francisco Bay ambient concentration (Water Board 1998). Risk-based concentrations for aluminum and methoxychlor were calculated using the same modeling methods and parameters presented in the SLERA. This calculation was performed by setting the hazard quotient (HQ) equal to 1.0 and then solving for the sediment concentration in the dose. This process is known as "back-calculating." Back-calculations were conducted using the high toxicity reference values to identify

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			<p>risk-based concentrations for each receptor and chemical of ecological concern with a refined HQ based on the high toxicity reference value greater than 1.0. As a result, the risk-based concentration for methoxychlor was based on the willet, and the risk-based concentration for aluminum was based on the house mouse.</p> <ul style="list-style-type: none"> The text of Section 3.3.3 (first paragraph on page 3-11) will be revised as follows. "Ecological risk-based concentrations were calculated...in the SLERA (Appendix B). <i>These methodologies include back calculation of concentrations using dose modeling, as well as comparison to ER-M values (Long and others 1995) and ambient concentrations (Water Board 1998).</i>"
10.	---	<p>The TMSRA includes a discussion of risk characterization. However, this discussion does not provide information regarding the nature and extent of contamination as it relates to potential impacts regarding ecological receptors in Parcel B. That is, the TMSRA should include a complete discussion on the spatial distribution of hazard quotient exceedances for ecological receptors in Parcel B in order to establish the COPECs [chemicals of potential ecological concern] that are risk drivers. Please revise the TMSRA to include this information.</p>	<ul style="list-style-type: none"> The data set used for the SLERA includes sediment samples collected along all of the accessible areas of the shoreline at Parcel B. The SLERA considered this data set as a whole to identify COPECs and to estimate ecological risks. The SLERA concluded that the data presented in the TMSRA "...indicate that risk to benthic invertebrates, birds, and mammals from several metals and organic compounds in sediment and groundwater along the Parcel B shoreline cannot be ruled out. Specific chemicals in sediments that pose risk to one or more ecological receptors include: metals – aluminum, copper, lead, molybdenum and zinc; pesticides – dieldrin, methoxychlor, 4,4-DDT and total DDT; total Aroclors; and dibenz(a,h)anthracene. Mercury is the only chemical in groundwater that poses a risk to ecological receptors." The remediation alternative proposed for the shoreline (revetment) will be uniformly applied to the entire shoreline. Consequently, the remediation will be protective of ecological receptors, regardless of the distribution of HQ exceedances. Please refer to the response to EPA specific comment 59 for discussion of remediation alternatives for mercury. No change to the report is proposed from this comment.
11.	---	<p>It is noted that a tidal marsh wetland is present in IR-07, and that this wetland will be removed due to recommended remediation alternatives. It is also stated that the removal of this wetland will be mitigated. No information is provided in the TMSRA to clarify how the loss of this wetland area will be compensated. Please revise the TMSRA to provide a complete discussion of the wetland area, and describe how the loss of the wetland area will be compensated.</p>	<ul style="list-style-type: none"> The text of Section 3.2 (last partial paragraph on page 3-8) will be modified as follows to reference the location of the detailed wetland information. "The shoreline of IR-07 consists of about 1.5 acres and includes approximately 1,300 square feet of tidal marsh wetlands. <i>A detailed description of the wetlands can be found in the Wetlands Delineation and Functions and Values Assessment report (Tetra Tech 2002b).</i> The shoreline..." The Navy will discharge fill material into the wetland at IR-07 in a manner consistent with Nationwide General Permit 38 (Cleanup of Hazardous and Toxic Waste) available under the Army Corps of Engineers Nationwide Permit program

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			<p>at 33 CFR § 330. Nationwide Permit 38 is contained in 67 Fed. Reg. 2020, Appendix B. The Navy will comply with the substantive provisions of the Nationwide Permit 38, including general conditions contained in 67 Fed. Reg. 2020, Appendix C as a means of compliance with Section 404 of the Clean Water Act and its implementing regulations (33 U.S.C. § 1344, 40 CFR § 230.10 and 230.11, and 33 CFR § 323). These conditions include requirements to delineate the wetland, discharge suitable material, and mitigate the loss of the wetland by creating a new wetland that provides a functional replacement for the wetland loss. The Navy will mitigate the loss of the wetland using one of the following methods: compensatory mitigation, mitigation banking, or an in-lieu fee arrangement. The final details of the plan for wetland mitigation will be included in the remedial design.</p> <ul style="list-style-type: none"> • The text of Section 4.3.2.1 describing the containment general response action (first full paragraph on page 4-21) will be revised as follows. “The shoreline revetment would be constructed to protect the entire shoreline for the redevelopment blocks where the revetment is necessary. <i>The 1,300-ft² wetland at Redevelopment Block BOS-1 would be filled and the Navy would mitigate the loss of the wetland using either compensatory mitigation, mitigation banking, or an in-lieu fee arrangement.</i>” A similar change will be made to Section 5.1.1 describing Alternative S-2 (page 5-2). In addition, the text of Section 5.1.1 (end of second paragraph of Alternative S-2) will be revised as follows. “Further refinement of the details of the shoreline revetment, <i>including the plan for wetland mitigation</i>, will occur during the remedial design.” • Action-specific ARARs will be revised to reflect the substantive provisions of 33 CFR § 320 and 40 CFR § 230 as follows: 33 CFR § 320.4, 40 CFR §§ 230.10, 230.11, 230.20-230.25, 230.31, 230.32, 230.41, 230.42, and 230.53. • Follow-up: 33 CFR 323 was also added.

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Specific Comments			
1.	---	<u>Executive Summary, Table ES-1 Ranking of Remedial Alternatives for Soil and Groundwater</u> : Soil alternative S-2 scores lower overall than soil alternative S-3; however, the scores for the two alternatives are equivalent except for cost. Soil alternative S-2 is lower in cost; therefore, it appears that soil alternative S-2 should score better overall than soil alternative S-3. Please revise the overall scores so that S-2 scores “very good” and S-3 scores “good” or clarify why S-3 is scored higher overall.	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 70.
2.	ES-3	<u>Executive Summary, Parcel B History and Setting, Page ES-3</u> : It is stated in this section that no threatened or endangered species are expected to occur in the area. However, no information is provided in the document to explain how this assumption was derived (e.g., site-specific surveys, communication with local, state, and federal agencies, database searches, among others). Please revise the TMSRA to provide this information.	<ul style="list-style-type: none"> This statement is taken directly from the Parcel B feasibility study (FS) report (PRC 1996) and does not represent any new information. The TMSRA is intended to update new information and not to recharacterize all aspects of Parcel B. Site conditions at Parcel B related to endangered species have not changed since the remedial investigation (RI) and FS and there is no need for additional information. The reference will be added to this sentence in the executive summary.
3.	1-1	<u>Section 1.0, Introduction, Page 1-1</u> : This section should include the date Hunters Point Shipyard (HPS) was placed on the National Priorities List (NPL). Please revise the introduction to include the date HPS was placed on the NPL.	<ul style="list-style-type: none"> The text of Section 1.0 (second paragraph on page 1-1) will be modified as follows. “The Navy is cleaning up Parcel B at HPS under the IR program ... hazardous substances. <i>HPS was included on the National Priorities List in November 1989.</i>”
4.	1-3	<u>Section 1.3, Purpose and Organization of Report, Page 1-3</u> : The text states that quarterly groundwater monitoring has been conducted for more than 4 years, but quarterly monitoring has actually been conducted for more than 6 years. Please make this change. In addition, the discussion of groundwater contamination should include the 2005 data. Please revise the TMSRA to include a discussion of groundwater contamination in 2005.	<ul style="list-style-type: none"> The text of Section 1.3 (third full paragraph on page 1-3) will be revised as follows. “The Navy removed more than 100,000 cubic yards...and conducted quarterly groundwater monitoring for more than 6 years.” The inset box on page ES-4 of the executive summary describing remedial actions since the ROD (first bullet under groundwater) also will be updated to indicate 26, not 24, quarters of monitoring. Narrative descriptions of groundwater data in the TMSRA will be updated to account for samples collected through May 2006. For example, the mention of the mercury concentration at well IR26MW47A in Section 2.3.2 will be updated from the 0.7 micrograms per liter (µg/L) value for June 2005 to not detected at 0.34 µg/L for May 2006. However, the risk assessments and databases included in the TMSRA will not be updated for samples collected after November 2004. The Navy has reviewed the results of samples collected after November 2004 and

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			has found no reason to expect that the new data would change the results of the risk assessments or the selection or evaluation of remediation alternatives. Presentations and evaluations of groundwater data collected after November 2004 are available in other reports for Parcel B. Section A9.0 discussing the uncertainties involved in the HHRA will be expanded to include a brief discussion of the qualitative evaluation of the data collected after November 2004 and the minimal effect on the risk assessment results.
5.	---	Table 1-1, CERCLA Chronology for Parcel B: This table should include the second proposed plan or the title of the upcoming document that will take its place. Please include the second proposed plan or the document that will take its place.	<ul style="list-style-type: none"> The row in Table 1-1 immediately below the row identifying the TMSRA indicates the next proposed plan for Parcel B. The title for the next proposed plan will be changed in Table 1-1 to <i>Proposed Plan in Support of a ROD Amendment</i>.
6.	2-5 & 2-6	Section 2.1.3.2, History of Groundwater Actions, Page 2-5 and 2-6: It is not clear from the Hexavalent Chromium (Cr6+) Investigation Report (the Cr6+ Report, which is provided in Appendix H) that the extent of Cr6+ is limited to the immediate area around well IR10MW12A, since the study in the vicinity of IR10MW12A did not extend below 12 feet below ground surface (ft bgs). Please revise the third sentence of the discussion, to clarify that the extent of Cr6+ was not delineated below 12 ft bgs in the vicinity of IR10MW12A.	<ul style="list-style-type: none"> This paragraph will be revised as follows. "The Navy installed 10 temporary monitoring wells in the A-aquifer in 2002 at locations down-, cross-, and up-gradient from well IR10MW12A to monitor concentrations of chromium VI in groundwater in the area of this well. These wells were installed...and evaluate site conditions. <i>Borings for these wells extended to 12 to 15 feet bgs and the wells characterized the full extent of the A-aquifer in the area around well IR10MW12A. In addition, borings for these wells found clay beneath the A-aquifer and the study concluded that downward migration of chromium VI was unlikely based on the low hydraulic conductivity of the clay, the large available surface area for adsorption, and the high potential for reduction of chromium VI to chromium III by organic material, iron, and manganese contained in the clay.</i> The study found the extent of chromium VI was limited to the A-aquifer in the immediate area around well IR10MW12A. Appendix H contains..." Follow-up: The depth of sanitary sewer and storm drains lines in the area of well IR10MW12A were also of concern because these lines may have been sources for a release of chromium VI. However, these lines were found to be located at 6.5 to 7 feet bgs during their removal as part of the radiological cleanup at Parcel B. Therefore, the 2002 investigation of chromium VI discussed above likely also included any potential source contributions from sanitary sewer and storm drain lines.

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7.	2-7	<p><u>Section 2.1.4, History of Treatability Studies, Page 2-7:</u> This section refers to the pilot-scale SVE [soil vapor extraction] system at Building 123; however, it is not clear whether the system is still in place and operational. It is also unclear whether a rebound test is being done. Please revise the TMSRA to clarify whether the SVE system is still present at Building 123 and discuss whether a rebound test is part of this treatability study.</p>	<ul style="list-style-type: none"> The second paragraph describing the SVE study in Section 2.1.4 will be replaced with the following text. “‘The Navy expanded the pilot-scale SVE system at Building 123 during January through May 2005 by installing 24 soil gas probes, nine SVE wells, and six vapor monitoring well pairs (ITS1 2006). The SVE system operated from June 15 through September 13, 2005 when the system was shut down for rebound monitoring. Monitoring for rebound continued through December 15, 2005. The SVE system operated again from January 3 to January 11, 2006 when operations ended.’” “‘Vapor monitoring using a photoionization detector indicated that VOCs were reduced to below detection levels in 22 of 23 SVE wells and 27 of 28 vapor monitoring wells. VOC concentrations rebounded (to varying degrees) in 14 of the 23 SVE wells. The treatability study report recommended that the system be expanded to include additional vapor extraction wells and operated to remove additional VOCs. The system remains in place in the event it is utilized during future remedial action.’”
8.	2-11	<p><u>Section 2.1.5.4, First Five-Year Review, Page 2-11:</u> The text of the fourth bullet indicates that the portions of IR-10 that have not been excavated will have to be addressed if SVE is not selected as a remedy, but arsenic, beryllium and manganese will not be addressed by SVE. Since these metals are present in the area designated as Excavation 10-2, which was never opened, remediation may be necessary. Please revise the text of this bullet to clarify that SVE will not address metals contamination at IR-10 and state whether these metals will be addressed by the alternatives proposed in the TMSRA.</p>	<ul style="list-style-type: none"> The following text will be added to the fourth bullet. “<i>The TMSRA also contains remediation alternatives to address metals concentrations that exist in soil in the same area at IR-10; these metals would not be treated by the SVE system. Metals will be addressed by ensuring that the exposure pathway is broken by a cover consistent with the rest of Parcel B.</i>”
9.	2-15 & 2-16	<p><u>Section 2.2.4.1, Hydrostratigraphic Units, Page 2-15 and 2-16:</u> The description of the distribution of the B-Aquifer in Parcel B does not fully support the TMSRA, since some reviewers may not have access to the B-Aquifer Tech Memo. Figure 5 of the B-Aquifer Tech Memo would be a useful addition to the TMSRA to facilitate comparison of the distribution of the B-Aquifer and the extent of the Bay Mud Aquitard with the groundwater figures in the HHRA. Please include Figure 5 of the B-Aquifer Tech Memo in the TMSRA.</p>	<ul style="list-style-type: none"> The TMSRA is not intended to reproduce information that is available in existing reports. The reference provided in the text is sufficient to allow readers to locate the cited information. The Navy maintains an information repository at the main San Francisco library located at 100 Larkin Street. The units corresponding to the A- and B-aquifers will be identified in the legend of Figure 2-4.

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10.		Placeholder, no comment 10.	<ul style="list-style-type: none"> No response necessary.
11.	2-17 & 2-18	<p><u>Section 2.3.1, Overview of Soil, Pages 2-17 and 2-18 and Figure 2-6, Post-Excavation Arsenic Concentrations in Soil 0 to 10 Ft bgs:</u> Although the text suggests that arsenic is naturally occurring, ATSDR [Agency for Toxic Substances and Disease Registry] states that arsenic was used as an antifouling additive to paint, so it is possible that areas with higher concentrations of arsenic were impacted by disposal of arsenic contaminated fill (i.e., IR 07) or by sandblasting and painting operations (i.e., in IR26, which is adjacent to Dry Dock 3). Therefore, concentrations of arsenic above the HPAL may be related to former shipyard activities and disposal operations. Since copper, mercury, and zinc were also antifouling additives, antimony was used in batteries, and cadmium was used in plating operations; these metals should not be described as naturally occurring when they occur at concentrations above the HPALs. Please revise the text in this section to discuss historic uses of these metals and delete text that refers to them as naturally occurring.</p> <p>In addition, there is a discrepancy between the text and Figure 2-6. The figure title indicates that post-excavation concentrations of arsenic are shown, but the last sentence on page 2-17 states that the two areas with clusters of elevated arsenic concentrations have been excavated. Please resolve this discrepancy.</p>	<ul style="list-style-type: none"> Please refer to the response to EPA general comment 5. The arsenic concentrations in the highest range (30 to 240 milligrams per kilogram [mg/kg]) on Figure 2-6 all represent bottom composite samples collected post-excavation. The text of Section 2.3.1 will be revised as follows. “Although apparent clusters of higher arsenic concentrations appear in two locations (both of which were excavated during the remedial actions), most arsenic concentrations are distributed across Parcel B with no apparent pattern to indicate their presence due to a release. <i>Both locations on Figure 2-6 that indicate high arsenic concentrations (red symbols) represent bottom composite samples collected after excavations were completed.</i> This distribution of arsenic ...”
12.	2-18 & 2-19	<p><u>Section 2.3.2, Overview of Groundwater, Pages 2-18 and 2-19:</u> There is no discussion of stratigraphic windows where hydraulic communication between the A and B Aquifers is likely to occur. According to Figure 5 of the Bay Mud tech memo, the A-Aquifer appears to be in contact with the B-Aquifer (i.e., the Bay Mud is absent) at the western end of IR-10 and adjacent to the Parcel C boundary in IR-06 and IR-25. Specifically, it appears that the two aquifers are in contact in the vicinity of the IR-10A, IR-10B and IR-25 Risk Plumes. The updated overview of groundwater should include a description of these stratigraphic windows, since this data was unknown when the ROD was written. Please revise Section 2.3.2 to include a discussion of the stratigraphic windows to the B-Aquifer beneath the IR-10A, IR-10B and IR-25 Risk Plumes and their significance for vertical contaminant migration.</p>	<ul style="list-style-type: none"> Section 2.2.4.1 discusses the updated knowledge of the distribution of the B-aquifer and the Bay Mud Deposits. The text of the third paragraph of Section 2.2.4.1 will be expanded as follows. “Bay Mud Deposits act as an aquitard... are adjacent. <i>Hydraulic communication is restricted, although not prevented, in areas where Bay Mud Deposits are present, and the potential for communication between the A- and B-aquifers is greater where the Bay Mud Deposits are absent. However, previous investigations (Tetra Tech 2001) concluded that, although lithologic data suggest the potential for communication, chemical results do not indicate communication exists. Groundwater elevation data for the western portion of IR-18 consistently indicate higher elevations in the B-aquifer than the A-aquifer, indicating the vertical groundwater flow gradient is directed upward from the B- to the A-aquifer in this area.</i>”

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			<ul style="list-style-type: none"> Also please refer to the response to EPA general comment 3 for discussion of evaluation of potential communication in the HHRA.
13.	2-18	<p><u>Section 2.3.2, Overview of Groundwater, Page 2-18:</u> It is unclear why the text states that there are two groundwater plumes in Parcel B, but then discusses three plumes. Since Cr6+ and mercury were each observed in a single well, the mercury detections in IR-26 should also be considered a groundwater plume. Further, mercury is soluble in groundwater and volatilizes easily when groundwater is exposed to air, this could account for some of the variability in mercury concentrations. Please revise the text to state that there are three groundwater plumes and include the mercury plume on a figure.</p>	<ul style="list-style-type: none"> The second paragraph of Section 2.3.2 will be replaced with the following text. <i>“COCs [chemicals of concern] in groundwater in the A-aquifer include (1) VOCs, especially trichloroethene and its breakdown products, (2) chromium VI, and (3) mercury. Some of these COCs are found in samples from multiple wells and represent plumes in groundwater. Other COCs are found in only individual wells and are not referred to as plumes. One plume of VOCs is found in a group of wells located at IR-10 and is termed the IR-10A risk plume in the HHRA (please refer to Appendix A, Attachment A4 for the definitions and methodology behind selection of risk plumes). This plume was the target of a ZVI [zero-valent iron] injection treatability study and has been monitored for many years by the RAMP [remedial action monitoring program]. Chromium VI has been detected consistently in samples from well IR10MW12A and has historically been termed a “plume” even though detections have been limited to a single well. The HHRA and the TMSRA maintain that convention and refer to the chromium VI concentrations at well IR10MW12A as the IR-10B plume. Figure 2-7 shows the locations of VOCs and chromium VI at IR-10. Mercury has been detected consistently in samples from well IR26MW47A, but only in samples from that well and this TMSRA does not define this single well as a plume. The location of well IR26MW47A is shown on Figure 2-3 near the eastern edge of Parcel B. The remainder of this section discusses these COCs in greater detail in preparation for the HHRA discussion to follow in Section 3.0.”</i> Follow-up: The Navy does not agree that a detection of mercury at 0.6 µg/L (equal to the HGAL) in a sample collected from new well IR26MW49A in September 2006 demonstrates that a mercury plume exists at IR-26. The descriptions of groundwater plumes at Parcel B were not changed.
14.	2-18	<p><u>Section 2.3.2, Overview of Groundwater, Page 2-18:</u> The third paragraph of this section should be updated, since VOC concentrations in IR10MW59A increased during 2005. Please revise the third paragraph to include VOC trends observed in 2005.</p>	<ul style="list-style-type: none"> The TMSRA is not intended to reproduce information that is available in existing reports. Trends in VOC concentrations at well IR10MW59A are discussed in quarterly monitoring reports for Parcel B; trends at well IR10MW59A do not affect the overall evaluation of groundwater for the IR-10 area. Text will be added to this paragraph as follows. “Figures 2-8, 2-9, and 2-10 illustrate the distributions of these three VOCs in groundwater near Building 123,

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			<p><i>based on the November 2004 samples (Kleinfelder 2005). Samples collected in May 2006 indicated maximum concentrations of 27 µg/L trichloroethene, 78 µg/L cis-1,2-dichloroethene, and 39 µg/L vinyl chloride (CE2-Kleinfelder 2006c)."</i></p> <ul style="list-style-type: none"> Figures 2-8, 2-9, and 2-10 will not be revised. Also refer to the response to EPA specific comment 4.
15.	2-18 & 2-19	<p><u>Section 2.3.2, Overview of Groundwater, Pages 2-18 and 2-19:</u> It is not clear why the only potential source of Cr6+ discussed in the text is a spill from the loading dock or ramp. Other potential sources of Cr6+ include releases from the acid drain line inside the building or from the storm drain sanitary sewer lines. Since it is likely that used chromic acid was discharged into the sewers or storm drains and that chromic acid that spilled on the floor was washed into floor drains, the storm drains and sanitary sewers should be considered possible sources of Cr6+. Please revise the text to discuss other possible sources of Cr6+.</p> <p>In addition, the extent of Cr6+ has not been determined because the investigation was limited to the area above 12 ft bgs. Please acknowledge this limitation in the text.</p>	<ul style="list-style-type: none"> The text of this paragraph (first partial paragraph on page 2-19) will be expanded as follows. "...area for building construction. <i>Other potential chromium VI sources include an acid drain line and associated tank, a concrete vault, and a brick unit all of which were inside Building 123 adjacent to well IR10MW12A (refer to Appendix H for more details).</i>" Please refer to the response to EPA specific comment 6 for discussion of limitations of the chromium VI investigation.
16.	2-19	<p><u>Section 2.3.2, Overview of Groundwater, Page 2-19:</u> It is not clear why the text states that the "current data for VOCs in groundwater at RU-C5 do not indicate that the plumes extend into Parcel B," since the soil gas and hydropunch study being conducted to delineate the extent of the RU-C5 plumes in the vicinity of the Parcel B/C boundary indicates that VOCs in soil gas have migrated across the boundary. Please update this discussion with all available information from the B/C boundary study.</p>	<ul style="list-style-type: none"> The text in Section 2.1.2 (first paragraph on page 2-4) will be expanded as follows to discuss the results of the B/C boundary investigation. "Field activities for this investigation were completed in March 2006 and a final investigation summary report was submitted in November 2006 (CE2 2006). The investigation found (1) that dissolved-phase VOCs in groundwater in the shallow A-aquifer have migrated from Parcel C to Parcel B, but concentrations at Parcel B were below maximum contaminant levels (MCL), (2) that there was no indication of dense nonaqueous phase liquids (DNAPL) in the aquifer at Parcel B, and (3) that there was no evidence for migration of DNAPLs onto Parcel B from Parcel C." The text of Section 2.3.2 in the first full paragraph on page 2-19 will be revised as follows. "The extent of plumes at RU-C5 is under investigation, including whether the plumes extend into Parcel B, was investigated between August 2005 and March 2006. The investigation found that concentrations of VOCs in this area were below MCLs. Although..."

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17.	---	<u>Figure 2-1, Radiologically Impacted Areas and Buildings and Table 2-2, Radiologically Impacted Sites</u> : According to Section 8.3.7.2 of the Final Historic Radiological Assessment (the HRA), all ships berths and piers are considered radiologically impacted, but this is not shown on Figure 2-1 or included in Table 2-1. Please indicate that all berths and piers in Parcel B are radiologically impacted on Figure 2-1 and in Table 2-1.	<ul style="list-style-type: none"> Figure 2-1 will be modified to indicate that ship berths and piers are radiologically impacted. The following note will be added to Table 2-2. "Ship berths and piers at Parcel B are considered to be radiologically impacted."
18.	---	<u>Figure 2-2, Excavation Location Map</u> : It appears that some excavations are not shown on this map. For example, excavations 10-1 and 10-2 are not shown. Since the text mentions excavations that were not opened in IR-10, all IR-10 excavations should be shown on this map. Excavations that were not opened should be shown in a different color.	<ul style="list-style-type: none"> The TMSRA does not discuss excavations that were never opened (at IR-10 or any other location at Parcel B). Data from samples collected from areas termed 10-1 and 10-2 were included in the HHRA, as were data from all the other excavations at Parcel B. The requested information is currently available on Figure 1-2 of the Construction Summary Report (Tetra Tech 2002a). No change to the report is proposed from this comment.
19.	---	<u>Figure 2-4, Hydrogeological Conceptual Model</u> : It is unclear why all three cross-sections are oriented roughly northeast-southwest. A cross-section that ties the three sections presented on this figure should also be prepared. Please consider providing a northwest-southeast oriented cross-section.	<ul style="list-style-type: none"> Cross section orientations roughly parallel the sedimentary depositional direction as well as the direction of groundwater flow (from the upland, bedrock hills toward the bay). The selection and orientation of cross sections for the conceptual model were discussed during the TMSRA storyboard meeting with the BCT on August 18, 2004. The TMSRA was not intended to provide a complete reinterpretation of the subsurface geology at Parcel B, but to update the interpretation provided in the FS, as needed. An additional cross section is not necessary to support the selection and evaluation of remediation alternatives.
		In addition, for cross-section B-B' it is unclear why there is a break in the depiction of the Bay Mud and Undifferentiated Sedimentary deposits between borings IR10B003 and IR46B034, since there are no borings in this area. In addition, what information is there that fill directly overlies bedrock under Building 131, since no borings appear to have been completed in this area? Since it appears that information from other nearby borings was used, it would be helpful to include those borings in a different color/weight line on the lines of section. Please clarify how the cross-sections were created and specify whether data from other borings in the vicinity of the lines of section were used. If not, please explain why there is a break in the depiction of the Bay Mud and Undifferentiated Sedimentary deposits between borings IR10B003 and IR46B034 and explain why it was concluded that fill directly overlies bedrock under Building 131. In addition, please include all borings used to create these cross-sections on the figures, using a different color/weight line if	<ul style="list-style-type: none"> The gap in the Bay Mud between borings IR10B003 and IR46B034 reflects removal of the Bay Mud by dredging. This interpretation is consistent with that provided in the FS report (PRC 1996) and the Bay Mud and B-Aquifer Technical Memorandum (Tetra Tech 2001). The interpretation in the vicinity of Building 131 (should be Building 113) is based on boring PA42B004. It is possible that other stratigraphic units exist between the base of boring PA42B004 (11.5 feet bgs) and bedrock. Borings used to create the cross sections are indicated on the cross section. Wells and boring locations are included on the figures contained in Appendix F. Cross section C-C' will be modified to show artificial fill beneath Excavation EE-05.

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		<p>necessary. Finally, please provide a plan-view map that includes all wells and borings completed in Parcel B.</p> <p>For cross-section C-C', it is not clear that Excavation EE-05 was excavated to bedrock as shown on this cross-section, since soil confirmation samples were collected from the bottom of this excavation.. Please revise the cross-section in this area to show fill beneath this excavation or explain how it was concluded that EE-05 was excavated to bedrock.</p>	
20.	---	<p><u>Table 2-3, RAMP Wells and Exceedances:</u> There are several discrepancies between this table and analytical results for Q20 and Q21. Please resolve the following discrepancies:</p> <ul style="list-style-type: none"> The following wells were not sampled during Q20, but Table 2-3 indicates that these wells were sampled: IR07MW23A, IR07MW27A, IR61MW05A and UT03MW11A; The following exceedances were not reported for Q20: Manganese at IR07MWS-4, Mercury at IR26MW47A, Vinyl chloride IR10MW61A, and Trichloroethene (TCE) and Vinyl chloride at IR10MW71A; 	<ul style="list-style-type: none"> The cited four wells will be shown as not sampled on Table 2-3. The cited exceedances will be indicated on Table 2-3, except well IR10MW71A. This well exceeded comparison criteria in Q20 for TCE and DCE, not TCE and vinyl chloride. Table 2-3 does not indicate any exceedances for well IR10MW62A. No change to the table is proposed from this comment. The cited exceedance for chromium VI at well IR10MW12A will be indicated on Table 2-3.
		<ul style="list-style-type: none"> Vinyl Chloride and Cis-1,2-dichloroethene (DCE) were not detected in IR10MW62A. The exceedance of Cr⁶⁺ at IR10MW12A during Q21 was not identified. 	
21.	3-3	<p><u>Section 3.1.1, Exposure Scenarios and Pathways, Page 3-3:</u> It is not clear why the mercury plume in IR 26 was not considered a groundwater risk plume. Since mercury dissolves in groundwater and volatilizes when groundwater is exposed to air, at a minimum, risks to construction workers and industrial workers should be calculated for this plume. Please revise the HHRA to include the IR-26 mercury plume as a groundwater risk plume.</p>	<ul style="list-style-type: none"> The HHRA will be revised to include an evaluation of risks from inhalation of mercury volatilized from groundwater for residential receptors (vapor intrusion exposure), industrial receptors (vapor intrusion exposure), and construction worker receptors (construction trench exposure). The extent to which mercury in groundwater may partition from a dissolved to a gaseous phase is uncertain; therefore, the plume- and nonplume-based exposure areas already established in the draft TMSRA will be used to evaluate risks from vapor inhalation of mercury. Plume-based exposure areas will not be re-delineated based on mercury. Inhalation exposure to mercury will be evaluated for each plume-based and

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			<p>nonplume-based exposure area where mercury is detected in groundwater. These exposure areas include industrial grid AY02 and residential grid B6006, which encompass monitoring well IR26MW47A at IR-26. The evaluation of risks from vapor intrusion of mercury for these grid locations will be presented in Attachment A3 of the HHRA, which contains groundwater risk results for each exposure scenario, regardless of the planned reuse. Note, however, that grids AY02 and B6006 are associated with Redevelopment Block BOS-3, for which the planned reuse designation is open space. Because the groundwater vapor intrusion exposure pathway is incomplete for the recreational exposure scenario, mercury in groundwater ultimately would not be identified as a COC for these grids, based on vapor intrusion exposure. Depending on the risk evaluation results for the construction worker scenario, mercury at this location could potentially be identified as a COC for the construction worker.</p> <ul style="list-style-type: none"> • Follow-up: The risk evaluation results added mercury as a COC for the potential future resident and the construction worker. • The TMSRA evaluates excavating and removing additional soil beneath Excavation EE-05 to remove potentially remaining mercury source material.
22.	3-5	<p><u>Section 3.1.3.1, Total Risk Evaluation, Page 3-5:</u> It is not clear why the Construction Worker Scenario is not considered applicable for surface soil. Since the surface will be exposed during construction, risk from exposure to surface soil should be calculated for the construction worker. Please revise the HHRA to include an evaluation of risks to construction workers from surface soil and revise the table on page 3-5 to include the chemicals of concern for this scenario or state that the residential or industrial exposure routes will be used to address the construction worker exposure to surface soils.</p>	<ul style="list-style-type: none"> • Based on discussion and an agreement with the BCT in March 2004, evaluation of construction worker exposure to soil in the HHRA included surface soil in the evaluation of COCs in soil from 0 to 10 feet bgs. A separate risk evaluation is not necessary. No change to the report is proposed from this comment.
23.	3-7 & 3-8	<p><u>Section 3.1.4, Risk Summary for Groundwater, Pages 3-7 and 3-8:</u> The B-Aquifer is present at Parcel B in more areas than discussed in the text. For example, the discussion in Section 3.1.4 indicates that the B-Aquifer is predominantly absent in Parcel B except in the western portion of the parcel, but according to Figure 5 of the B-Aquifer Tech Memo, the B-Aquifer appears to be distributed over a larger area in the central portion of the Parcel B than it is in the western portion. Please revise the discussion of locations where the B-Aquifer exists to be consistent with the depiction of the B-Aquifer on Figure 5 of the B-Aquifer Tech Memo.</p>	<ul style="list-style-type: none"> • Please refer to the responses to EPA general comment 3 and specific comment 12. • The text of Section 3.1.4 in the first partial paragraph on page 3-8 will be revised as follows. "COCs for the B-aquifer...are summarized below. <i>Section A9.0 in Appendix A contains additional discussion of risks posed by potential communication between the A- and B-aquifers at Parcel B.</i>"

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24.	---	<u>Section 3.4, Updated Risk Evaluation by Redevelopment Block</u> : Since the discussion of each section includes a statement about the risks related to groundwater, monitoring wells in each redevelopment block should be included on the figures. This would help clarify whether there is any groundwater information for the redevelopment blocks. Please revise Figures 3-11 through 3-25 to include all monitoring wells and indicate wells that are currently sampled under the Remedial Action Monitoring Program (RAMP) using a separate color or unique symbol.	<ul style="list-style-type: none"> Locations of groundwater monitoring wells will be added to Figures 3-11 through 3-25; wells that are part of the RAMP will be identified.
25.	3-11	<u>Section 3.4.1, Redevelopment Block 1, Page 3-11</u> : Appendix A does not contain any groundwater samples from wells adjacent to Redevelopment Block 1; therefore, it is not clear how human health risks from groundwater were evaluated for this area in the HHRA. For example, according to the second paragraph of this section, "Redevelopment Block 1 is identified for mixed use and was evaluated using a residential exposure scenario in the HHRA," and, "The HHRA did not find any unacceptable risks related to groundwater beneath Redevelopment Block 1." Please discuss how the exposure pathways for vapor intrusion and domestic use of the B-Aquifer were evaluated for Redevelopment Block 1, given that Appendix A does not contain groundwater data for this area.	<ul style="list-style-type: none"> The text of Section 3.4.1 will be revised as follows. "The HHRA did not find any unacceptable risks related to groundwater beneath <i>evaluate groundwater at Redevelopment Block 1 because there are no groundwater monitoring wells located at this block. Previous investigations at Redevelopment Block 1 found no cause for installation of groundwater monitoring wells.</i>" If there is no reason to suspect VOCs in Redevelopment Block 1, then vapor intrusion is not a viable exposure pathway. Similarly, if groundwater contamination is not suspected at Redevelopment Block 1, the domestic use pathway would not be viable. However, an institutional control is proposed to prohibit groundwater extraction for domestic use for all of Parcel B. This will facilitate implementation and enforcement prohibiting use of groundwater for domestic purposes.
26.	3-12	<u>Section 3.4.2, Redevelopment Block 2, Page 3-12 and Section 3.4.3, Redevelopment Block 3, Page 3-12</u> : The RI Report states that IR-07 was also used for sandblasting and painting submarine superstructures and that additional waste oils may have been disposed in IR-07, but this is not reflected in the text of the TMSRA. Please revise the description of past activities at IR-07 to include this information.	<ul style="list-style-type: none"> The text of Sections 3.4.2, 3.4.3, and 3.4.13 will be revised as follows. "<i>Past activities at IR-07 that may have contributed to soil contamination include, painting submarine superstructures, disposal of sandblast waste, disposal of additional waste oils, and placement of construction debris as fill.</i>"
27.	3-13	<u>Section 3.4.5, Redevelopment Block 5, Page 3-13</u> : This redevelopment block also includes most of IR-62, including the transformer shed at the northeast corner of Building 115, which was not investigated during the original RI, and Tank S-135, which was located northwest of Building 116, but IR-62 is not discussed in the text. Please revise the text to include a discussion of IR-62. Also, Building 115 does not appear to be labeled on Figure 3-15 or on other figures with building numbers. Please	<ul style="list-style-type: none"> The text of Section 3.4.5 will be revised as follows. "Redevelopment Block 5 includes parts of IR-23 <i>and IR-62</i> in the west-central portion of Parcel B. Past activities at IR-23 that may have been sources for contamination include surface spills of petroleum. <i>Past activities at IR-62 involved primarily storage of fuel-related chemicals; a transformer substation at Building 115 may have also contained PCB [polychlorinated biphenyl]-bearing oil.</i> Redevelopment Block 5 includes Buildings <i>115 (offices and training).</i> 116 (submarine training

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		label Building 115 on Figure 3-15.	<p>school)...(submarine barracks). <i>Redevelopment Block 5 also included former Tanks S-135 and S-136. Former Tank S-135 was located northwest of Building 116; former Tank S-136 was located south of Lockwood Street south of Buildings 121 and 146. Tanks S-135 and S-136 were closed by the Water Board in 2002.</i></p> <ul style="list-style-type: none"> Figure 3-15 and other figures in the TMSRA showing building numbers will be updated to label Building 115.
28.	3-14	<p><u>Section 3.4.5, Redevelopment Block 6, Page 3-14:</u> IR-23 also included a photograph development laboratory, Building 146, but this use and the possible associated contamination are not discussed in the text. Please revise the text to include a more complete description of the past activities in this redevelopment block.</p> <p>In addition, since it appears that there are no monitoring wells in Block 6, it is unclear how a conclusion about risks related to groundwater can be made. Please delete this conclusion or explain the basis for this conclusion.</p>	<ul style="list-style-type: none"> The text of Section 3.4.6 will be revised as follows. “Past activities at IR-23 that may have been sources for contamination include surface spills of petroleum <i>and use of photograph development chemicals at Building 146.</i>” Wells UT03MW16A, PA50MW01A, IR61MW04A, and IR61MW05A are located at Redevelopment Block 6. The HHRA used data from these wells to conclude there were no unacceptable risks. Locations of these monitoring wells will be added to Figure 3-16. No change to the text of the report is proposed from this comment.
29.	3-14	<p><u>Section 3.4.7, Redevelopment Block 7, Page 3-14:</u> It is unclear why the only sources of contamination included in the text for IR-42 are “surface spills of petroleum.” Building 113 was used as a machine shop, for torpedo maintenance, as a shipyard analytical laboratory, and had an electrical substation. PCBs and metals are other likely contaminants, based on former site use. Please expand the description of contamination related to past activities at IR-42 to include metals and PCBs.</p> <p>In addition, since it appears that there are no monitoring wells in Block 7, it is unclear how a conclusion about risks related to groundwater can be made. Please delete this conclusion or explain the basis for this conclusion.</p>	<ul style="list-style-type: none"> The text of Section 3.4.7 will be revised as follows. “Past activities at IR-42 that may have been sources for contamination include surface spills of petroleum, <i>chemicals associated with nondestructive testing, and PCB-bearing oil associated with electrical transformers.</i>” Follow-up: This sentence was further revised to read “Past activities at IR-42 that may have been sources for contamination include surface spills of petroleum chemicals associated with nondestructive testing, <i>torpedo maintenance, and machine shop activities,</i> and PCB-bearing oil associated with electrical transformers.” Wells IR10MW15A and IR06MW46A are located at Redevelopment Block 7. The HHRA used data from these wells to conclude there were no unacceptable risks. Locations of these monitoring wells will be added to Figure 3-17. No change to the text of the report is proposed from this comment.

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30.	3-14 & 3-15	Section 3.4.8, Redevelopment Block 8, Pages 3-14 and 3-15: Other activities and uses that may have contributed contamination include the 9 transformers that were located in sumps in the southeast corner of Building 123, but the text does not include this information. Please include this former use and clarify if the transformers are still in place.	<ul style="list-style-type: none"> The text of Section 3.4.8 will be revised as follows. "Past activities at IR-10 that may have been sources of contamination include releases of waste acids and plating solutions from floor drains inside Building 123, and leaks from acid drain lines and an industrial drain line, and releases of PCB-bearing oil associated with transformers. The transformers are no longer in place at Building 123."
31.	3-14 & 3-15	Section 3.4.8, Redevelopment Block 8, Pages 3-14 and 3-15; and Appendix A, Table A3-2, Groundwater Data Statistical Summary, IR-10B Plume, Aquifer: It appears that the HHRA may have underestimated the risk posed by Cr6+ in the IR-10B groundwater plume, since the concentration of Cr6+ at well IR10MW12A increased to 670 ug/L during Q24. Although the Cr6+ concentrations at IR10MW12A have historically exhibited a fluctuating trend, the Q24 result was the highest concentration measured since the RI Report was issued. Please revise Section 3.4.8 to discuss the increase in Cr6+ concentrations in 2005 to benchmark levels last seen during the RI. Please also revise Table A3-2 of Appendix A to identify the Q24 result for Cr6+ (670 ug/L) as the maximum concentration measured for this analyte.	<ul style="list-style-type: none"> The text of Section 3.4.8 will be revised as follows. "The two most recent samples collected from well IR10MW12A detected chromium VI at 240 µg/L (collected in March 2006) (CE2-Kleinfelder 2006b) and 487 µg/L (collected in May 2006) (CE2-Kleinfelder 2006c). Follow-up: The following information about chromium VI concentrations was added to Sections 2.3.2 and 3.4.8. "The maximum concentration of chromium VI detected at well IR10MW12A was 680 µg/L (collected in December 2005). The maximum concentration of chromium VI in the HHRA data set was 550 µg/L (collected in March 2004)." Please note that aquatic organisms in the bay are not affected by fluctuations in chromium in groundwater at well IR10MW12A because it is over 400 feet from the bay. The risk assessment evaluation for the construction worker concluded that noncancer risk (hazard index) caused by chromium is about 4.38×10^{-6}. Also, there is no residential risk to chromium since there is no exposure pathway. Therefore, the risk posed by hexavalent chromium does not appear to have been underestimated in the HHRA. Please refer to the response to EPA specific comment 4 concerning the request to update the data set and discuss more recent trends in groundwater concentrations.
32.	3-15	Section 3.4.9, Redevelopment Block 9, Page 3-15: Based on the RI Report, there are other past activities that may have resulted in releases; these activities include oils, solvents, and corrosives from the machine shop in Building 128; and oils, paints, and solvents from Building 130. Please include this information in the text.	<ul style="list-style-type: none"> The text of Section 3.4.9 will be revised as follows. "Past activities at IR-24 that may have been sources for contamination include surface spills of petroleum and releases of diesel fuel and lubrication oils along distribution pipelines (IR-46) that ran through IR-24, and releases of oils, solvents, paints, and corrosives from Buildings 128 and 130." Samples were collected from areas of suspected releases during the RI and those samples not removed by subsequent investigations are included in the HHRA.

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33.	3-15 & 3-16	<u>Section 3.4.10, Redevelopment Block 12, Pages 3-15 and 3-16:</u> Other past activities that may have resulted in releases include the use and storage of oils, paints, and solvents in Building 130 (IR-24). In addition, the RI Report states that waste oils and chemicals were stored in the southwest portion of IR-20; this may have included areas outside Building 156. Please include this information in the text.	<ul style="list-style-type: none"> • The text of Section 3.4.10 will be revised as follows. “Past activities at IR-20 that may have contributed to contamination in soil include spills of waste oil and chemicals within <i>and outside of</i> Building 156. Past activities at IR-24 that may have been sources for contamination include surface spills of petroleum and releases of diesel fuel and lubrication oils along distribution pipelines (IR-46) that ran through IR-24, <i>and releases of oils, solvents, and paints from Building 130.</i>” • Samples were collected from areas of suspected releases during the RI and those samples not removed by subsequent investigations are included in the HHRA.
34.	3-16	<u>Section 3.4.11, Redevelopment Block 15, Page 3-16:</u> Other past activities in IR-26 that may have resulted in releases include welding and fabricating metal parts in Building 157; this operation may have resulted in releases of solvents and metals. In addition, Block 15 is close to Dry Dock 3, and open areas may have been used for sandblasting or have been impacted by sandblasting operations in the Dry Dock. Please include this information in the text.	<ul style="list-style-type: none"> • The text of Section 3.4.11 will be revised as follows. “Past activities at IR-26 that may have been sources for contamination include surface spills of petroleum, <i>welding and fabrication of metal parts, and sandblasting.</i>” • Samples were collected from areas of suspected releases during the RI and those samples not removed by subsequent investigations are included in the HHRA.
35.	3-17	<u>Section 3.4.12, Redevelopment Block 16, Page 3-17:</u> The text does not discuss possible activities or uses that resulted in the mercury contamination of IR-26. Since globules of mercury were found in this area; the discussion in the text should include activities/uses that may have resulted in the release of mercury. In addition, Block 16 is adjacent to Dry Dock 3, and open areas may have been used for sandblasting or have been impacted by sandblasting operations in the Dry Dock. This may explain the presence of arsenic in this area, since arsenic was used as an antifouling additive to paint. Please include this information in the text.	<ul style="list-style-type: none"> • The text of Section 3.4.12 will be revised as follows. “Past activities at IR-26 that may have contributed to contamination in soil include surface spills of petroleum, and releases of chemicals from the dock shipwright’s shop, <i>and sandblasting.</i>” • No historical uses of mercury were identified related to activities or buildings at Redevelopment Block 16. An email communication from consultants for EPA (TechLaw 2006) indicated that the presence of free mercury had been reported at a meeting of the Base Realignment and Closure Cleanup Team (BCT) sometime in the past. However, reports documenting the excavation activities at Excavation EE-05 (IT 1997, Tetra Tech 2002a) do not report the presence of free mercury. Although mercury concentrations as high as 482 mg/kg were measured in samples collected at nearby Excavation EE-05, free mercury was not reported during excavation or sampling activities. Additional source control activities will be evaluated for mercury in the draft final TMSRA. • Follow-up: The Navy reviewed field notes taken during the original (1996) and subsequent (2000 to 2001) removals at Excavation EE-05 and found no record that free mercury was observed. Statements that free mercury was observed that occur in Parcel B groundwater monitoring reports are incorrect and will be revised.

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36.	3-17 & 3-18	Section 3.4.13, Redevelopment Block BOS-1, Pages 3-17 and 3-18: Other uses of IR-07 that may have resulted in releases include sandblasting and painting submarine superstructures and disposal of waste oils. In addition, elevated levels of copper and zinc were found in the Fuel Line F excavation; the extent of these contaminants at 3 ft bgs has not been delineated. Please include this information in the text.	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 26. Fuel Line F Figures A and B of the Construction Summary Report (Tetra Tech 2002a) illustrate the completed delineation for copper (Figure B) and zinc (Figure A) at the excavation for Fuel Line F. The HHRA considered detections of metals from all soil samples remaining in place at the excavation for Fuel Line F at Redevelopment Block BOS-1. Elevated metals concentrations are found throughout IR-07. It is assumed that some contaminated fill was placed at IR-07 to expand the land area of the parcel. This is one of the primary reasons the Navy proposes to amend the Parcel B ROD. No change to the report is proposed from this comment. Follow-up: The bottom composite samples cited at 3 feet bgs were removed when the excavation was deepened to 6 feet bgs.
37.	3-18	Section 3.4.14, Redevelopment Block BOS-2, Page 3-18: Other activities that may have resulted in releases from IR-24 include oils, solvents, and corrosives from the machine shop in Building 128; it appears that a portion of Building 128 is included in BOS-2. In addition, Block BOS-2 is adjacent to Dry Docks 5, 6, and 7, and open areas may have been used for sandblasting or have been impacted by sandblasting operations in Dry Docks 5, 6, and 7. Please include this information on the text.	<ul style="list-style-type: none"> The text of Section 3.4.14 will be revised as follows. "Past activities at IR-24 that may have been sources for contamination include surface spills of petroleum and releases of diesel fuel and lubrication oils along distribution pipelines (IR-46) that ran through IR-24, <i>and releases of oils, solvents, paints, and corrosives from Building 128. Decontamination of ships from Operation Crossroads at Dry Docks 5, 6, and 7 may also have affected this redevelopment block (Radiological Affairs Support Office 2004).</i> Redevelopment Block BOS-2 includes Buildings 133 and 159 (both latrines) <i>and a small portion of Building 128.</i>"
38.	3-18	Section 3.4.15, Redevelopment Block BOS-3, Page 3-18: The text does not discuss possible activities or uses that resulted in the mercury contamination of IR-26. Since free mercury was found in this area; the discussion in the text should include activities/uses that may have resulted in the release of mercury. In addition, portions of Block BOS-3 are adjacent to Dry Dock 3, and open areas may have been used for sandblasting or have been impacted by sandblasting operations in the Dry Dock. This may explain the presence of arsenic in this area, since arsenic was used as an antifouling additive to paint. Please include this information in the text.	<ul style="list-style-type: none"> The text of Section 3.4.15 will be revised as follows. "Past activities at IR-26 that may have contributed to contamination in soil include surface spills of petroleum, and releases of chemicals from the dock shipwright's shop. <i>Decontamination of ships from Operation Crossroads at Dry Dock 3 may also have affected this redevelopment block (Radiological Affairs Support Office 2004).</i>" No historical uses of mercury were identified related to activities or buildings at Redevelopment Block BOS-3. Although mercury concentrations as high as 482 mg/kg were measured in samples collected at nearby Excavation EE-05, free mercury was not reported during excavation or sampling activities. Also refer to the response to EPA specific comment 35.

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39.	3-18 & 3-19	Section 3.4.15, <u>Redevelopment Block BOS-3</u> , Page 3-18 and 3-19: There is a discrepancy between discussion of mercury detections in groundwater well IR26MW47A and the analytical results presented in the appendices. For example, in the second paragraph the Navy states, "Mercury was detected consistently in groundwater samples from well IR26MW47A at concentrations ranging from 1 ug/L to 2.8 ug/L from May 2003 through November 2004." However, according to Appendix F, mercury has been detected in every groundwater sample collected at this location, beginning in Q9. Please revise the discussion of Mercury detections at well IR26MW47A to be consistent with the analytical results in Appendix F.	<ul style="list-style-type: none"> The text of Section 3.4.15 will be revised as follows. "Mercury was detected consistently in groundwater samples collected from well IR26MW47A (grid AY02) at concentrations ranging from 0.18 to 2.8 µg/L from <i>March 2002 when the well was installed</i> through November 2004."
40.	---	Figure 3-9, <u>Groundwater Domestic Use Risks in B-Aquifer, Residential Exposure Scenario</u> : It is not clear why the groundwater domestic use risks in the B-Aquifer were not based on planned reuse designations. For example, cancer risks greater than 1E-6 were identified for two residential grids based on the residential exposure scenario; however, the domestic use exposure pathways are considered incomplete in these exposure areas, since they have been designated for open space reuse. Please revise Figure 3-9 to depict groundwater domestic use risks in the B-Aquifer based on planned reuse.	<ul style="list-style-type: none"> If groundwater in the B-aquifer is used as a drinking water source, it is likely that the radius of influence from a domestic well would extend beyond the boundaries of a 50-foot by 50-foot residential grid. For this reason, risks and COCs for domestic use of groundwater in the B-aquifer are not based on the specific planned reuse designations for Parcel B. This approach provides an additional measure of conservatism with respect to the protection of human health at HPS. No change to the report is proposed from this comment.
41.	4-2	Sections 4.0 and 4.1.1, <u>Remedial Action Objectives for Soil</u> , Page 4-2: Section 4.0 refers to an RAO for sediments; please identify the sediment RAO. Section 4.1.1 of the TMSRA states that no ecological RAOs were developed for soil at Parcel B because the parcel contains no identified terrestrial habitat, but Section 4.1.1.2 indicates that an RAO was developed for soil and shoreline sediment at Parcel B to protect ecological receptors. These statements appear to be contradictory. Please revise the TMSRA to clarify that an ecological RAO was developed for soil and sediment in specific areas at Parcel B.	<ul style="list-style-type: none"> The sediment RAO stated in Section 4.1.1.2 will be revised as follows. "Prevent exposure of ecological receptors to organic and inorganic compounds in soil and shoreline sediments <i>in shoreline areas</i> above remediation goals established for sediment." The first paragraph of Section 4.1.1 will be revised as follows: "Separate RAOs are typically developed for human health receptors and for ecological receptors. <i>Ecological RAOs were only developed for soil and sediment in shoreline areas.</i> No ecological RAOs were developed for <i>other</i> soil at Parcel B because most of the land is paved and the parcel contains no identified terrestrial habitat. Therefore, RAOs for soil are developed based on human health receptors."

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42.	4-6	<p>Section 4.2, <u>Potential Applicable or Relevant and Appropriate Requirements (ARARs)</u>, Page 4-6: The quoted definitions provided in this section differ from those in the National [Oil and Hazardous Substances Pollution] Contingency Plan (NCP), 40 CFR Section 300.5; italics indicate where the definitions vary. The text states that “applicable requirements are those cleanup standards, standards of control, and other substantive <i>environmental protection requirements</i>, criteria, or limitations promulgated under federal or state law that specifically address <i>the situation at a CERCLA site.</i>” The text defines “relevant and appropriate requirements” as “those cleanup standards, standards of control, and other substantive <i>environmental protection requirements, criteria, or limitations</i>, promulgated under federal or state law that, while not applicable, address problems or situations <i>similar to the circumstances of the proposed response action and are well suited to the conditions of the site.</i>” Specifically, the National Contingency Plan (40 CFR Section 300.5) defines applicable requirements as “those cleanup standards, standards of control and other <i>substantive requirements</i>, criteria, or limitations promulgated under federal <i>environmental or state environmental or facility siting laws</i> that specifically address a <i>hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site....</i>” The National Contingency Plan defines relevant and appropriate requirements as “those cleanup standards, standards of control, and other <i>substantive requirements</i>, criteria, or limitations promulgated under federal <i>environmental or state environmental or facility siting laws that, while not ‘applicable’ to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site</i>, address problems or situations <i>sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site....</i>” Please revise this section to quote the National Contingency Plan definitions.</p>	<ul style="list-style-type: none"> • The text of Section 4.2 should not have stated that the definitions were quoted from the NCP. The text is based on EPA ARARs policy guidance and the NCP but slightly adapted to be more understandable to the general public. • The text of the first paragraphs of Section 4.2 will be replaced as follows, and the discussion of the terms applicable or relevant and appropriate will be listed as simple text (that is, not indented or contained within quotation marks). • “An ARAR may be either applicable or relevant and appropriate, but not both. The NCP (40 CFR Part 300) defines applicable and relevant and appropriate as follows. <p>Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.</p> <p>If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (EPA 1988). A requirement must be determined to be both relevant <u>and</u> appropriate in order to be considered an ARAR.”</p>

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43.	4-10 & 4-11	Section 4.2.3.1, Potential Action-Specific ARARs for Soil Alternatives, Pages 4-10 and 4-11: In this section, the Navy first indicates that the ARARs for construction of the shoreline revetment and the covers for soil are listed in the subsection beginning on page 4-10 and then, in a later subsection, lists two ARARs specific to the construction of the shoreline revetment under a new subtitle. Please either remove the reference to the construction of the shoreline revetment from the subtitle on 4-10 and include all ARARs related to the construction of the shoreline revetment under the subtitle on page 4-11 or remove the "Construction of the Shoreline Revetment" subtitle from 4-11.	<ul style="list-style-type: none"> • In the first subsection, titled Constructing the Shoreline Revetment and Covers for the Soil, the Navy has identified requirements that are potential ARARs for <u>both</u> the construction of the shoreline revetment and the construction of the soil covers. In the second subsection, titled Construction of the Shoreline Revetment, the Navy has identified requirements that are potential additional ARARs <u>only</u> for the shoreline revetment. The RCRA temporary tank requirements and the Clean Water Act dredge and fill requirements are only potential ARARs for the construction of the shoreline revetment—not the soil covers. • The title on page 4-11 will be revised to "Construction of a Shoreline Revetment (<i>Only</i>)," and the following sentence will be added before the bullet list for further clarification. <i>"The Navy has identified the following potential action-specific ARARs that apply only to the construction of the shoreline revetment:"</i>
44.	4-14	Section 4.3.2, Development of General Response Actions, Page 4-14: General response actions (GRAs) are listed for soil and groundwater; however, it is not clear if the GRAs also apply to sediment. For clarity, please include GRAs for sediment, or indicate that the GRAs developed apply to soil and sediment.	<ul style="list-style-type: none"> • The first paragraph of Section 4.3 states: "...As in Section 4.2, options related to remediation of sediment and soil gas are discussed together with the other options for soil because of the similarity of the actions and technologies." No change to the report is proposed from this comment.
45.	4-19	Section 4.3.2.1, Evaluation of Applicable Soil Process Options, Page 4-19: The TMSRA rejects excavation of shoreline sediments as a remedial process option due to the difficulties of excavating along the shoreline; however, the shoreline revetment option includes excavation of approximately 6,000 cubic yards of sediments. It is also necessary to remove existing rip-rap in order to construct the revetment. Please revise the TMSRA to clarify the difference between the excavation process option and the excavation required for the revetment that makes the excavation process option infeasible (location and depth of sediments requiring removal, for example).	<ul style="list-style-type: none"> • The excavation of IR-07 fill material, which includes or is adjacent to the shoreline sediment, was recommended for further evaluation in the five-year review report based on practical constraints in excavating all the fill material. However, installation of the revetment will require some excavation to establish appropriate grades and to allow placement of erosion control materials at appropriate elevations relative to sea level. The cost estimate for the revetment construction assumed 6,000 cubic yards as a conservative approach. The actual amount of sediment to be removed will be estimated during the remedial design. • The text of the second paragraph on page 4-19 will be revised as follows: "...are added challenges to excavation along the shoreline. <i>In addition, the location and depth of the sediments as well as the location of contaminants within the sediments along the shoreline that may require remediation are not known in sufficient detail to remove them by excavation.</i> These added difficulties make excavation along the shoreline..." • Follow-up: Additional information on the depth of contaminated sediment compared with the depth of excavation to construct the revetment was considered, but this information is not known with enough confidence to include in the report.

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			<ul style="list-style-type: none"> The text of the first full paragraph on page 4-21 will also be revised as follows to clarify the excavation that is proposed in conjunction with construction of the shoreline revetment. <i>“The shoreline revetment would be constructed to protect the entire shoreline for the redevelopment blocks where the revetment is necessary. Installation of the revetment will require some excavation to establish appropriate grades and to allow placement of erosion control materials at appropriate elevations relative to sea level. However, this excavation is only incidental as part of the construction and would not be intended to focus on removal of contaminants. Similar to soil covers, the revetment will need to be maintained...”</i>
46.	4-23	<p><u>Section 4.3.2.2, Evaluation of Applicable Groundwater Process Options, Page 4-23:</u> The text states that, “Passive groundwater treatment includes the process options of groundwater monitoring and natural recovery,” but groundwater monitoring is not a treatment technology; this is acknowledged in the fourth sentence. Since groundwater monitoring is not treatment, it cannot be considered a passive treatment technology. Please resolve this discrepancy.</p> <p>In addition, it appears that the process option is not “natural recovery,” but “monitored natural recovery” or “monitored natural attenuation” (MNA), since groundwater monitoring is a necessary part of this process option. Please rename this process option to reflect the actual intent of the process.</p>	<ul style="list-style-type: none"> Section 4.3.2.2 will be revised to include “Groundwater Monitoring” as a GRA. The discussion of groundwater monitoring under the GRA of “Treatment” will be deleted from this section and placed under the heading of “Groundwater Monitoring.” Tables 4-2 and 4-3 will be updated to reflect this change. A preliminary screening of MNA parameters was conducted in accordance with “Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water” (EPA 1998a). Data were not sufficient to indicate ongoing natural biodegradation at Parcel B because data were not available for several key parameters. However, the contaminants in groundwater will naturally attenuate via dispersion, dilution, and adsorption (and, potentially, biodegradation). Additionally, VOCs at IR-10 will continue to degrade in response to the ZVI treatability study (ERRG and URS 2004). These processes will be monitored as part of the groundwater monitoring option and the process option termed “Natural Recovery” will be removed. The following discussion of groundwater monitoring will be inserted on page 4-23 under a title of “Groundwater Monitoring” (immediately before the section titled “Treatment”) and the existing section on passive treatment will be deleted. <i>“Groundwater monitoring is an effective process option for assessing changes in the concentrations of VOCs and mercury. Groundwater monitoring can detect potential increases in concentrations or migration of contaminants that could increase the risk of exposure of humans or aquatic life in the bay. Reductions in concentrations of VOCs have been observed over time at Parcel B, most likely as the result of treatability studies (such as ZVI injection). Groundwater monitoring</i>

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			<p><i>was a central component of the remedy for groundwater in the 1997 ROD. The monitoring option is easy to implement at relatively low cost. This option will be retained for development and evaluation of remedial alternatives.”</i></p> <ul style="list-style-type: none"> Similar changes will be made at other locations in the text to describe groundwater monitoring without discussion of natural recovery.
47.	---	<p><u>Table 4-1, Screening of General Response Actions and Process Options for Soil and Table 4-3, Analysis of General Response Actions and Process Options for Soil and Groundwater:</u> Fencing and barriers are not institutional controls (ICs) as indicated in these tables; these process options are considered engineering controls. Please include engineering controls as a process option and revise the text and tables accordingly.</p>	<ul style="list-style-type: none"> The discussion of fencing, barriers, and signs in Tables 4-1 and 4-3 will be listed as a separate row with a title of “Engineering Controls” in the Process Option column.
48.	---	<p><u>Table 4-2, Screening of General Response Action and Process Options for Groundwater:</u> Groundwater Monitoring is included in this table as a passive treatment technology; however, monitoring is not treatment. It appears that monitoring should be listed as a separate GRA. For clarity, please revise this table to list monitoring as a separate GRA, rather than a treatment technology type.</p>	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 46.
49.	---	<p><u>Table 4-3, Analysis of General Response Actions and Process Options for Soil and Groundwater:</u> The table indicates that ICs are effective at preventing exposure of receptors to contamination; however, ICs are not effective for ecological receptors. Please revise this table to clarify that ICs will not protect ecological receptors.</p> <p>In addition, ICs are not generally sufficient to prevent human exposure in and of themselves; generally some type of engineering control like fences, barriers, and/or vegetation also are needed to prevent exposure. Please revise this table to clarify that ICs are not sufficient to prevent exposure, but a combination of ICs and engineering controls can prevent exposure. Also, please revise the descriptions of the alternatives to include both engineering controls and ICs.</p>	<ul style="list-style-type: none"> Table 4-3 will be revised as follows. “Effective at preventing exposure of <i>human</i> receptors to contamination, especially when used in combination with other options; <i>does not prevent exposure of ecological receptors</i>; does not reduce the volume or toxicity of contamination (EPA 2000b).” Institutional controls can be used to prevent domestic use of groundwater, which includes several exposure pathways. However, institutional controls must be used in conjunction with engineering controls to prevent other types of exposure (for example, ingestion or dermal adsorption from contaminated soil). The screening comments for institutional controls on Table 4-3 will be revised as follows. “Retained – easily implemented and effective; not sufficient to prevent exposure alone, but effective in combination with engineering controls.”

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50.	---	<u>Table 4-3, Analysis of General Response Actions and Process Options for Soil and Groundwater:</u> This table lists excavation and methane source removal as separate technology types; however, they seem to be identical. It is not clear why methane source removal is listed as a separate technology type. To avoid potential confusion, please revise this table to remove methane source removal as a separate technology type, or clarify how it differs from the excavation option.	<ul style="list-style-type: none"> Tables 4-1 and 4-3 will be revised to combine methane source removal and excavation. Methane source removal will be removed from the tables. The screening comment on Table 4-1 for excavation will be revised as follows. “Retained for organic compounds and lead, <i>and for excavation of soil where concentrations of methane or mercury above cleanup goals have been detected – effective; ...</i>” The description of excavation on Table 4-3 will be replaced with the following text. “<i>Excavation of contaminants using mechanical equipment.</i>” The screening comments for excavation on Table 4-3 will also be modified as follows. “Retained for organic compounds and lead; <i>retained for areas with methane concentrations in soil gas or mercury concentrations above cleanup goals; effective; easily implemented; fast.</i> Not retained for ubiquitous metals such as arsenic, iron, and manganese <i>or the heterogeneous fill areas of IR-07 and IR-18.</i>” Mercury source removal and methane source removal are important parts of the excavation portion of the soil remediation alternatives. Even though Tables 4-1 and 4-3 will be revised to refer simply to excavation, the names and descriptions of the remediation alternatives themselves will continue to include references to mercury and methane source removal to highlight the importance of those tasks.
51.	---	<u>Table 4-3, Analysis of General Response Action and Process Options for Soil and Groundwater:</u> Anaerobic bioremediation is evaluated as effective for reducing chlorinated VOCs; however, it is not clear if this technology will be effective on all contaminants in the IR-10A plume. Please revise the evaluation of anaerobic bioremediation to clarify whether it will be effective in reducing all VOCs, including vinyl chloride.	<ul style="list-style-type: none"> Contaminants of concern in the IR-10 plume include chloroform, TCE, and vinyl chloride. According to EPA’s document, “Engineered Approaches to In Situ Bioremediation of Chlorinated Solvents: Fundamentals and Field Applications” (EPA 2000a), TCE, chloroform, and vinyl chloride may be reduced through anaerobic biodegradation. This is shown on Exhibit 2-9 of the document. In addition, the anaerobic/aerobic in-situ bioremediation treatability study at Building 134 demonstrated that “The complete reductive pathway from PCE to ethene and ethane was observed. The data confirm that degradation at RU-C5 does not stall at cis-1,2-DCE or at VC, but results in the complete degradation to non-toxic ethene and ethane.” (Shaw Environmental 2005). Both aerobic and anaerobic biodegradation were retained as process options on Table 4-3. For cost estimating purposes, it is assumed in the TMSRA that the biodegradation substrate is a glycerol polylactate (for anaerobic biodegradation). However, the substrate and methods of injection will be finalized in the remedial design.

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			<ul style="list-style-type: none"> The effectiveness of anaerobic bioremediation will be changed on Table 4-3 to “Treatability study at Parcel C at HPS indicates anaerobic bioremediation is effective at reducing chlorinated VOCs, <i>including vinyl chloride</i>. Treatability study injected...” The screening comments will be revised as follows: “Retained, results from treatability study at Parcel C demonstrate effectiveness at reducing chlorinated VOCs, <i>including vinyl chloride</i>, relies on biodegradation, no adverse impact...”
52.	5-1	Section 5.1, Development of Remedial Alternatives, Page 5-1: The first sentence in this section states that all process options retained after the initial screening and detailed analysis met the RAOs and satisfied ARARs; however, ICs and monitoring are retained process options that will not meet RAOs if implemented alone. Please delete this sentence and revise this section to clarify that remedial alternatives will be developed from process options to meet RAOs and satisfy ARARs.	<ul style="list-style-type: none"> The first paragraph of Section 5.1 will be modified as follows. “<i>Process options were developed and screened as described in Section 4.0. The retained process options were combined into remedial alternatives to meet RAOs and to satisfy ARARs.</i> The remedial alternatives were derived using experience and engineering judgment to formulate process options into the most plausible site-specific remedial actions.”
53.	5-1	Section 5.1, Development of Remedial Alternatives, Page 5-1: The text states that the Navy’s strategy is to remediate soils that cannot be removed by eliminating complete exposure pathways to the receptors, or to treat soils contaminated with VOCs using SVE; however, it is not clear how VOCs will be addressed in alternatives which do not include SVE. It appears that, in Alternatives S-2, S-3 and S-4, VOCs in soil under Building 123 are to be addressed with ICs. Please revise the TMSRA to clarify how VOCs in soil will be addressed in Alternatives S-2, S-3, and S-4.	<ul style="list-style-type: none"> VOCs under Building 123 are COCs for future residents or construction workers. The risk pathways would be managed by Alternatives S-2, S-3, and S-4 through institutional controls. Use of Building 123 would be prohibited and future construction at this location would require engineering controls such as vapor barriers or vapor controls. The land-use control remedial design (LUC RD) or the risk management plan (RMP), or both, would require the development and approval of appropriate plans prior to use. The LUC RD would also prevent use of buildings over VOC plumes unless sufficient measures are taken to prevent exposure of residents to VOCs in soil or groundwater, possibly through the use of vapor barriers or other engineering controls. The first sentence in the second paragraph of Section 5.1 on page 5-1 will be revised as follows. “The Navy’s strategy for soil remedial alternatives is to remove the contaminated soil from the site by excavation and disposal wherever practical, to <i>prevent exposure</i> to soils that cannot be <i>completely</i> removed by eliminating complete exposure pathways to the receptors, or to treat soils contaminated with VOCs using SVE.” The description of Alternative S-2 in Section 5.1.1 will be revised as follows. “...posed by COCs in soil. <i>Institutional controls would require approved plans for construction activities that minimize risks to construction workers. Institutional controls will also prevent use of buildings over VOC plumes unless</i>

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			<i>sufficient measures are taken to prevent the exposure of residents to VOCs in soil or groundwater, possibly through the use of vapor barriers or other controls. A LUC RD will be prepared...</i>
54.	5-2 & 5-3	<u>Section 5.1.1, Alternatives Developed for Soil, Pages 5-2 and 5-3:</u> Since the source of methane is not known, it is possible that it may not be possible to remove it by excavation. For example, the organic material in the former Bay Sediments could be producing methane and it may be difficult to remove all of the Bay Sediments by excavation. To address this possibility, it is recommended that a contingency for venting be included in Alternatives S-3, S-4, and S-5. Please include a methane venting process option in the Section 4 tables and text and a contingency option to vent methane for Alternatives S-3, S-4, and S-5.	<ul style="list-style-type: none"> Methane is believed to be the result of the placement of construction debris as fill based on historical excavation activities at IR-07 and IR-18 and the limited extent of methane. A process option for methane venting will be added to Alternatives S-3, S-4, and S-5 and to the Section 4 tables in the event that excavation of the methane source material is found to be infeasible based on site conditions (for example, if methane is produced from organic material in the native sediments instead of from identifiable construction debris). Inclusion of this option will eliminate the need for an explanation of significant differences or ROD amendment that would otherwise be required to implement that change.
55.	5-2 & 5-3	<u>Section 5.1.1, Alternatives Developed for Soil, Pages 5-2 and 5-3:</u> The descriptions of Alternatives S-2, S-3, S-4, and S-5 do not appear to include the wetlands mitigation that will be necessary to restore the wetlands along the IR-07 shoreline that will be destroyed when the revetment wall is built. Please revise these alternatives to include wetlands mitigation.	<ul style="list-style-type: none"> The description of Alternative S-2 in Section 5.1.1 will be revised as follows. "...impact on the bay during construction. <i>The small wetland at IR-07 will be destroyed by revetment construction. The Navy will mitigate this loss using either compensatory mitigation, mitigation banking, or an in-lieu fee arrangement.</i>" Please also refer to the response to EPA general comment 11. A similar change will be made in Section 5.2.2. The estimated cost for wetland mitigation will be added to the cost estimates for Alternatives S-2 through S-5. The cost is anticipated to be less than \$100,000. However, most experts agree that wetland mitigation at HPS should be consolidated in one area. The most attractive location is at Parcel E-2.
56.	5-2	<u>Section 5.1.1, Alternatives Developed for Soil, Page 5-2:</u> ICs may not be sufficient to prevent exposure in Alternative S-2 because of the potential for contamination from blowing dust. At a minimum, this alternative should include vegetating areas with bare soil. Please revise Alternative S-2 to include vegetating areas of bare soil.	<ul style="list-style-type: none"> Exposure to wind-blown dust is not a significant pathway for human health risk compared to dermal contact and ingestion. No change to the report is proposed from this comment. Follow-up: EPA indicated that the primary concern related to this comment is exposure to asbestos. Alternatives S-2 and S-3 have been revised to include maintained landscaping over areas that have been disturbed by excavation or construction and not restored with a cover (for example, clean imported soil, asphalt, or concrete).

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57.	5-4	<u>Section 5.1.2, Alternatives Developed for Groundwater, Page 5-4:</u> This section refers to the zero valent iron (ZVI) injection treatability study and indicates that monitoring of the effectiveness of the treatability will be ongoing. However, the location and aerial extent of the treatability is not described or shown. Please revise the TMSRA to show where the ZVI treatability study was conducted and the area treated.	<ul style="list-style-type: none"> The location of the ZVI treatability study will be added to Figures 2-8, 2-9, and 2-10.
58.	---	<u>Section 5.2.4, Alternative S-4: Covers, Methane Source Removal, Institutional Controls, and Shoreline Revetment and Section 5.2.5, Alternative S-5: Excavation, Methane Source Removal, Disposal, Covers, SVE, Institutional Controls, and Shoreline Revetment:</u> It is unclear how much of Parcel B will be covered with hardscape (e.g., asphalt, concrete, and buildings) and how much will have a soil cover. Please provide a figure depicting areas that will have soil cover and areas that will be covered with hardscape and specify in the text the percentage of the Parcel that will be hardscape. Please also specify the aerial extent that will be new covers of each type.	<ul style="list-style-type: none"> The following paragraph will be added to Section 5.2.4, after the bulleted description of the covers. <i>"It is estimated from aerial photographs of Parcel B that approximately 8 acres will be covered with soil, 8 acres will be covered with new asphalt, 2 acres will be covered with maintained landscaping, and 28 acres of existing asphalt and concrete surfaces (including buildings) will be used and repaired, as necessary (see Figure 5-8). The estimates for each redevelopment block are listed in the cost tables in Appendix D. Actual extent of cover types will be identified in the remedial design."</i> The areas for soil or asphalt were estimated for cost estimating purposes. The remedial design will detail where soil, asphalt, or maintained landscaping is required to prevent exposure to COCs in soil. Follow-up: The estimates of cover types have been revised as follows. <i>It is estimated from aerial photographs of Parcel B that approximately 9 acres will be covered with soil, 7 acres will be covered with new asphalt, 3 acres will be covered by the shoreline revetment, and 40 acres of existing asphalt and concrete surfaces (including buildings) will be used and repaired, as necessary (see Figure 5-8).</i>
59.	---	<u>Section 5.3, Description of Groundwater Remedial Alternatives:</u> None of the remedies address mercury in groundwater at IR-26. Since mercury is soluble in groundwater and the extent of the mercury plume is not known, at least two additional wells to determine the extent of the mercury plume will be necessary. In addition, a remedy to address mercury, perhaps by excavating additional soil should be proposed. Please include two monitoring wells to delineate the extent of mercury in groundwater and also include a source removal component in the alternative to reduce the concentration of mercury in groundwater.	<ul style="list-style-type: none"> Alternatives GW-2 and GW-3 will be revised to include the addition of three new groundwater monitoring wells in the area near IR26MW47A to monitor the concentration of mercury in groundwater and the removal of mercury source material. Two groundwater monitoring wells (IR26MW49A and IR26MW50A) were installed in July 2006 near well IR26MW47A to monitor concentrations of mercury in groundwater. The third well will be installed within the area of Excavation EE-05, after the final remedy is selected and the mercury source removal is completed. These monitoring wells will be added to the Parcel B groundwater monitoring program.

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			<ul style="list-style-type: none"> • The following changes will be made to the TMSRA to include mercury source removal as part of the soil remediation alternatives: • Section 4.2.3.1, the text of the first paragraph will be revised as follows. "... (1) no action; (2) institutional controls and shoreline revetment; (3) excavation, methane <i>and</i> mercury source removal, institutional controls, and shoreline revetment; (4) covering portions of the site with soil, concrete, or asphalt, methane <i>and</i> mercury source removal, institutional controls, and shoreline revetment; (5) excavation, methane <i>and</i> mercury source removal, covers, SVE, institutional controls, and shoreline revetment." • Table 4-1, the screening comment on Table 4-1 for excavation will be revised as follows. "Retained for organic compounds and lead, <i>and for excavation of soil where concentrations of methane or mercury above cleanup goals have been detected</i> – effective..." • Table 4-3, the description of excavation on Table 4-3 will be replaced with the following text. "Excavation of contaminants using conventional mechanical equipment." The screening comments for excavation on Table 4-3 will also be modified as follows. "Retained for organic compounds and lead; <i>retained for areas with methane concentrations in soil gas or mercury concentrations above cleanup goals</i>; effective; easily implemented; fast. Not retained for ubiquitous metals such as arsenic, iron, and manganese..." • The following text will be added to Section 4.3.2.1 (following the first full paragraph on page 4-19), under the heading of "Removal": "<i>Likewise, excavation is expected to be effective in removing mercury source material present beneath former Excavation EE-05. The maximum depth of mercury source removal will be to bedrock (expected at about 15 feet bgs) or to the maximum depth practicable. The horizontal extent of mercury in soil was delineated to the ROD cleanup goal for mercury (the HPAL) during the remedial action. This delineation will provide the horizontal extent for the mercury source removal. Excavation at depths significantly below the groundwater level will be difficult because of dewatering considerations and may not be feasible because of the immediate proximity of the bay. Cone penetrometer tests or soil borings may be required to locate the depth of the bedrock in this area; the remedial design will specify the depth of the excavation. The excavation for removal of the mercury source will extend to bedrock unless local site conditions (for example, excessive</i>

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			<p><i>groundwater infiltration) prevent completion to bedrock. The costs for the removal of mercury source material are expected to be moderate. This process option will be retained for development and evaluation of remedial alternatives."</i></p> <ul style="list-style-type: none"> • Follow-up: Details of the soil sampling will be contained in the remedial design. The need for sidewall samples from the deepened Excavation EE-05 will be further discussed when the remedial design is prepared. • The text of the third paragraph of Section 5.1 (page 5-1) will be revised as follows. "Based on their location and extent (see Section 3.0), organic COCs (including the methane source), <i>mercury</i>, and lead in inland areas can be excavated..." • The title of Alternative S-3 will be changed to "Excavation, Methane <i>and Mercury</i> Source Removal, Disposal, Institutional Controls, and Shoreline Revetment." This title will be changed in Sections 5.1.1, 5.2.3, Tables ES-1, 5-2, 6-1, and 6-2, and in the appendices. Similar changes will be made to the titles of Alternatives S-4 and S-5. • Text in Section 5.1.1 describing Alternative S-3 on page 5-2 will be modified as follows. "Areas where organic compounds (including the methane source), <i>mercury</i>, and lead are COCs will be excavated to remediate these COCs to remediation goals." • Text in Section 5.1.1 describing Alternative S-4 on page 5-3 will be modified as follows. "Alternative S-4 also contains the same methane <i>and mercury</i> source removal components that are described in Alternative S-3..." • Text in Section 5.1.1 describing Alternative S-5 on page 5-3 will be modified as follows. "Alternative S-5 consists of a combination of soil excavation (included methane <i>and mercury</i> source removal) and off-site disposal..." • Text in Section 5.1.2 describing Alternative GW-2 on page 5-4 will be modified as follows. "Additionally, groundwater monitoring will be used to confirm site conditions and ensure that, over time, the potential exposure pathways remain incomplete. <i>Two groundwater monitoring wells have been installed near well IR26MW47A to monitor concentrations of mercury in groundwater. The third well will be installed within the area of Excavation EE-05, after the final remedy is selected and the mercury source removal is completed.</i> Alternative GW-2 will also provide for continued monitoring ..."

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			<ul style="list-style-type: none"> • The list in Section 5.2.3 will be revised to add the following bullet. <i>“Soil from the mercury source area at former Excavation EE-05 would be excavated (see Figure 5-6). The vertical extent of the mercury concentrations that exceed the remediation goal will be delineated to identify the mercury source material (horizontal delineation can be estimated from the previous remedial action). The cost estimate in this TMSRA assumes that contaminated soil will be excavated from within the area of former Excavation EE-05 from 10 feet bgs to a depth of 15 feet bgs (the estimated depth of bedrock in the area) over an area of 60 feet by 250 feet (for an estimated volume of about 2,800 cubic yards).”</i> • Text in the last paragraph of Section 5.2.4 on page 5-7 will be modified as follows. <i>“Alternative S-4 also contains the same shoreline revetment (see discussion in Alternative S-2) and methane and mercury source removal (see discussion in Alternative S-3) components.”</i> A similar change will be made to the last paragraph of Section 5.2.5 on page 5-8. • The first full paragraph of Section 5.3.2 on page 5-9 will be revised as follows. <i>“...shows the locations of the proposed monitoring wells. Two groundwater monitoring wells have been installed near well IR26MW47A to monitor concentrations of mercury in groundwater. The third well will be installed within the area of Excavation EE-05, after the final remedy is selected and the mercury source removal is completed. Details of groundwater monitoring...”</i> • A new figure will be added to show the approximate location of the excavation for mercury source removal. • Section 6.1.3 on page 6-7 will be revised as follows. <i>“...Alternative S-3 consists of (1) excavation and disposal of contaminated soil (including the mercury source), (2) excavation and disposal...”</i> • Section 6.1.3.1 on page 6-7 will be revised as follows. <i>“Alternative S-3 provides protection to human health and the environment because it would remove soil contaminated with organic compounds (including excavation of the methane source area), lead, and mercury that presents unacceptable risk...”</i>

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			<ul style="list-style-type: none"> • Section 6.1.3.3 on page 6-8 will be revised as follows. “Long-term effectiveness and permanence in areas where organic compounds, lead, <i>and mercury</i> would be excavated would be rated as excellent.” • The first full paragraph of Section 6.1.3.5 on page 6-9 will be revised as follows. “Construction efforts for the soil removal involve <i>five only four</i> areas to be excavated...” • Section 6.1.3.8 on page 6-9 will be revised as follows. “...long-term exposure to organic compounds, lead, <i>and mercury</i> is reduced through excavation, and the shoreline revetment prevents exposure to contaminated sediment.” • Section 6.1.4 on page 6-10 will be revised as follows. “Alternative S-4 includes (1) covers over entire blocks where there is unacceptable incremental risk, (2) excavation and disposal of soil and debris in the methane <i>and mercury</i> source areas, (3) institutional controls...” • Section 6.1.4.1 on page 6-10 will be revised as follows. “Similar to Alternative S-3, Alternative S-4 provides protection of human health and the environment because it would remove soil contaminated with organic compounds in the methane source area <i>and mercury in the mercury source area</i>.” • Section 6.1.4.3 on page 6-10 will be revised as follows. “Similar to Alternative S-3, long-term effectiveness and permanence in addressing the methane <i>and mercury</i> source areas is rated as excellent.” • Section 6.1.5 on page 6-12 will be revised as follows. “Alternative S-5 would involve removal of soils with organic compounds, lead, <i>and mercury</i> that pose a potential unacceptable risk.” • Section 6.1.5.1 on page 6-13 will be revised as follows. “Alternative S-5 provides the best protection to human health and the environment compared with other alternatives for soil because soil contaminated with organic compounds (including the methane source area), lead, <i>and mercury</i> that poses potential unacceptable risk would be removed...” • Section 6.1.5.3 on page 6-13 will be revised as follows. “Under Alternative S-5, soils with organic compounds, lead, <i>and mercury</i> that pose a potential unacceptable risk would be removed...”

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			<ul style="list-style-type: none"> • The fourth full paragraph of Section 6.1.5.5 on page 6-14 will be revised as follows. <i>“However, soil removals would involve five only four areas and a moderate volume of soil.”</i> • Section 6.1.5.8 on page 6-15 will be revised as follows. <i>“Organic compounds are removed by excavation and disposal or are treated using SVE. Mercury is removed by excavation. Long-term protectiveness...”</i> • Section 6.2.3 on page 6-16 will be revised as follows. <i>“Alternative S-3 provides long-term effectiveness and permanence for soil that contains organic compounds, lead, and mercury that is excavated, but relies on access restrictions for other COCs.”</i> • The second full paragraph of Section 6.3.2 on page 6-19 will be revised as follows. <i>“...adjust the requirements for data collection and analysis, and evaluate the need for other response actions. Two groundwater monitoring wells have been installed near well IR26MW47A to monitor concentrations of mercury in groundwater. The third well will be installed within the area of Excavation EE-05, after the final remedy is selected and the mercury source removal is complete.”</i> • Section 6.3.2.3 on page 6-20 will be revised as follows. <i>“Under Alternative GW-2, risks posed by exposure to COCs in groundwater are mitigated by preventing the exposure pathway to potential human receptors. Natural recovery is anticipated to be slow and may be more effective for VOCs than for mercury. The material in the aquifer matrix that is believed to be a continuing source of mercury in groundwater will be removed as part of the soil remediation alternatives. Groundwater monitoring will be used to evaluate the ongoing effectiveness of the mercury source removal as well as the groundwater treatments undertaken during treatability studies. The adequacy and reliability of this alternative depend on (1) the maintenance and enforcement of access restrictions (including installation of vapor controls barriers in new buildings), (2) the reliability of the long-term monitoring program, and (3) the completeness of the removal of the mercury source material from the aquifer. The monitoring parameters for natural recovery would be established in the monitoring program including...”</i>

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			<ul style="list-style-type: none"> Section 6.3.3.3 on page 6-23 will be revised as follows. "...would be reduced through in situ treatment. <i>Mercury source material will be excavated and removed from the site as part of the soil remediation alternatives.</i> The adequacy and reliability of this alternative also depends on the completeness of the removal of the mercury source material and on maintenance and enforcement of the access restrictions. The overall rating..." Please see the response to EPA specific comment 63 for changes to the ratings of Alternatives GW-3A and GW-3B. The ratings for each alternative will be updated, as necessary, on Tables ES-1 and 6-2. The executive summary and appendices will be updated with similar text to incorporate the three new groundwater monitoring wells and the mercury source removal.
60.	5-8	<p><u>Section 5.3.2. Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls, Page 5-8:</u> The TMSRA states that the objectives for the groundwater monitoring program include monitoring the effects of previous treatability studies; however, the locations of previous treatability studies are not shown on a figure. In order to demonstrate that the monitoring well network will effectively monitor the effects of previous treatability studies, it would be helpful if the locations and extents of those studies were shown on Figure 5-6, Proposed Monitoring Well Location Map. Furthermore, there do not appear to be any monitoring wells near the individual well which exhibited potential risk from chromium VI. Please revise the monitoring well network to include a monitoring well or wells near IR10MW12A.</p> <p>Both the Navy and EPA have guidance which is applicable to monitored natural attenuation (MNA). It would appear, based on the text in this section, that the document is referring to and proposing MNA. If so, there is specific guidance which must be addressed for this part of the remedy and this guidance presents requirements beyond mere monitoring. If the Navy is proposing MNA then it must be understood. Please reference the appropriate guidance and describe how those parameters, beyond monitoring, will be addressed.</p>	<ul style="list-style-type: none"> The locations of the ZVI and SVE treatability studies at Building 123 and the sequential anaerobic and aerobic bioremediation study at Building 134 will be added to Figure 5-7. Analysis for chromium VI will be added to wells IR10MW32A and PA50MW01A. Table 5-3 will be revised to add "Cr VI" as an analyte for both wells and the rationale will be changed to "Monitor possible migration of IR-10A VOC plume and IR-10B chromium VI plume." Please refer to the response to EPA specific comment 46 for the discussion of MNA, natural recovery, and groundwater monitoring. Follow-up: Monitoring well PA50MW01A has been replaced by well IR10MW81A.

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
61.	5-8	<p><u>Section 5.3.2, Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls, Page 5-8:</u> It is not clear how this alternative will address mercury at IR-26 and reduce the discharge of mercury to the Bay, since IR-26 is a shoreline site. For natural recovery/MNA to be applied, the source of mercury must be removed, but there is still mercury-contaminated soil at IR-26. Further, the mechanism for natural recovery when the contaminant of concern (COC) is mercury is unclear. If there is a precedent for natural recovery of mercury in a near-shore environment, the paper(s) should be provided to demonstrate that natural recovery/MNA of mercury is a viable alternative. Otherwise, this alternative will not be protective of the environment or pass ARARs. Please provide the appropriate paper(s) that demonstrate(s) natural recovery/MNA of mercury in groundwater in a nearshore environment or revise this alternative to include a viable process option for addressing mercury in groundwater.</p>	<ul style="list-style-type: none"> Two new groundwater monitoring wells have been installed, and one proposed well will be installed near well IR26MW47A to monitor the concentration and possible migration of mercury. In addition, Alternatives S-3, S-4, and S-5 will be modified to include removal of mercury source material. Also please refer to the response to EPA specific comment 59. Mercury is expected to attenuate through sorption to soil constituents, such as organic (humic) materials. Groundwater monitoring will track this process. Some precedents for selection of groundwater monitoring remedies at sites that involve mercury as a contaminant can be accessed at the MNAToolbox website, operated by DOE (http://www.sandia.gov/eesection/gc/gc/na/mna_hg.html). Among other examples, this website summarizes the use of groundwater monitoring for mercury and other metals, in conjunction with other remedial actions such as excavation and capping, at the Wyckoff Company/Eagle Harbor Superfund Site in Puget Sound on Bainbridge Island, WA. This is consistent with the Navy's proposal for source removal and groundwater monitoring. Also, please refer to the response to DTSC (Lanphar) specific comment 58 for more discussion on the groundwater monitoring to evaluate mercury. Follow-up: The clean fill used to backfill the excavation that will deepen Excavation EE-05 will act as a sink for mercury dissolved in groundwater based on the high sorptive capacity of the clean material.
62.	5-10	<p><u>Section 5.3.3, Alternatives GW-3A and GW-3B: In Situ Treatment with Reduced Groundwater Monitoring, and Institutional Controls, Page 5-10:</u> This section refers to a successful injection of ZVI as demonstrated during the pilot study at Parcel B; however, Table 4-3 indicates that injected ZVI followed preferential pathways and daylighted at the surface because of low-permeability soils during the pilot study. Please revise this section to discuss these implementability issues and how they might be addressed in this alternative.</p>	<ul style="list-style-type: none"> The "Cost and Performance Report, Zero-Valent Iron Injection Treatability Study, Building 123" (ERRG and URS 2004) states "Injection pressures were reduced to allow the maximum volume of iron to be injected without forming preferential pathways." The comment in Table 4-3 was intended to explain that the radius of influence is expected to be less than 10 feet because lower injection pressures would be required to minimize the potential for forming preferential pathways to storm drains or utility conduits. Therefore, more injection points would be necessary to inject the ZVI. The effectiveness of chemical reduction on Table 4-3 will be changed to: "Treatability study of ZVI injection at Parcel B resulted in substantial mass removal (ERRG and URS 2004), and appears to be effective on vinyl chloride based on recent groundwater monitoring results. Radius of influence at Parcel B was approximately 10 feet or less (ERRG and URS 2004) because lower

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
			<p><i>injection pressures were necessary to minimize preferential pathways and daylighting of the ZVI. Proven technology."</i></p> <ul style="list-style-type: none"> In monitoring well IR10MW61A, vinyl chloride has been reduced from a maximum of 240 µg/L in August 2004 to 39 µg/L in May 2006.
63.	5-10	<p><u>Section 5.3.3, Alternatives GW-3A and GW-3B: In Situ Treatment with Reduced Groundwater Monitoring, and Institutional Controls, Page 5-10:</u> This section does not discuss the effectiveness of the biodegradation substrate or the ZVI treatment on all of the VOCs in groundwater at Parcel B. It is not clear if the proposed biodegradation substrate will be effective in reducing vinyl chloride concentrations, for example. Please revise this section to discuss the effectiveness of the proposed substrates on each of the COCs in groundwater at Parcel B.</p>	<ul style="list-style-type: none"> The effectiveness of anaerobic biodegradation of VOCs, including vinyl chloride, is discussed in the response to EPA specific comment 51. Vinyl chloride was not detected during the ZVI treatability study at Building 123, but concentrations of TCE decreased 35 percent. The ZVI treatability study at Building 272, Parcel C, recorded a decrease in TCE of 98.3 percent and a decrease of chloroform of 93.9 percent (ITSI 2005). However, concentrations of vinyl chloride increased in one well, but decreased in two other wells and was not detected in three wells. Vinyl chloride concentrations at well IR10MW61A have been reduced from a maximum of 240 µg/L in August 2004 to 39 µg/L in May 2006. The analysis of Alternatives GW-3A and GW-3B in Section 6.3.3.3 on page 6-23 will be revised as follows. "The factors evaluated...and the adequacy and reliability of controls. <i>Treatability studies at HPS (ERRG and URS 2004, ITS1 2005) have demonstrated that in-situ bioremediation effectively reduces the concentration of VOCs in groundwater; ZVI is effective on vinyl chloride based on the results of groundwater monitoring at IR-10. Under Alternatives GW-3A and GW-3B, short-term risks...and enforcement of the access restrictions. The overall rating for Alternative GW-3A for long-term effectiveness and permanence is excellent, the overall rating for Alternative GW-3B is very good.</i>" The rating for GW-3B will be changed on Table 6-2 and ES-1 will be changed to "very good." The discussion on effectiveness of ZVI on Table 4-3 will be changed as shown in the response to EPA specific comment 62. Also, please refer to the response to EPA specific comment 59 for revisions to Section 6.3.3.3.
64.	---	<p><u>Figure 5-6, Proposed Monitoring Well Location Map:</u> This figure shows the area of highest VOC concentration and the extent of the "risk plume", but the extent of the existing VOC plume is not shown. In addition, the mercury plume in IR-26 is not shown. In order to demonstrate that the monitoring well network will be able to monitor changes in the extent of the plumes, please revise this figure to show the well locations with respect to the plume limits.</p>	<ul style="list-style-type: none"> The current VOC plume (shown on Figure 4-2) will be shown on Figure 5-7. The figure will also indicate the location of well IR26MW47A and the two newly installed wells (IR26MW49A and IR26MW50A).

TABLE 6.2: RANKING OF REMEDIAL ALTERNATIVES FOR SOIL AND GROUNDWATER

Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California

			Overall Protection of Human Health and the Environment	Compliance with ARARs ^a	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost (\$ Million)	Overall Rank by Alternative
SOIL ALTERNATIVES										
Alternative S-1: No Action	Not Protective	Not Applicable	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	0	<div></div>	<div>Legend:</div> <div><div></div> Not acceptable</div> <div><div></div> Poor</div> <div><div></div> Good</div> <div><div></div> Very Good</div> <div><div></div> Excellent</div>
Alternative S-2: Institutional Controls and Shoreline Revetment	Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	5.0	<div></div>		
Alternative S-3: Excavation, Methane and Mercury Source Removal, Disposal, Institutional Controls, and Shoreline Revetment	Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	7.5	<div></div>		
Alternative S-4: Covers, Methane and Mercury Source Removal, Disposal, Institutional Controls, and Shoreline Revetment	Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	8.8	<div></div>		
Alternative S-5: Excavation, Methane and Mercury Source Removal, Disposal, Covers, SVE, Institutional Controls, and Shoreline Revetment	Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	9.3	<div></div>		
Original ROD: Excavation, Disposal, and Institutional Controls	Not Protective	Does Not Meet ARARs	<div></div>	<div></div>	<div></div>	<div></div>	>100	<div></div>		
GROUNDWATER ALTERNATIVES										
Alternative GW-1: No Action	Not Protective	Not Applicable	<div></div>	<div></div>	<div></div>	<div></div>	0	<div></div>	<div>Legend:</div> <div><div></div> Not acceptable</div> <div><div></div> Poor</div> <div><div></div> Good</div> <div><div></div> Very Good</div> <div><div></div> Excellent</div>	
Alternative GW-2: Long-Term Monitoring of Groundwater and Institutional Controls	Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	1.6	<div></div>		
Alternative GW-3A: <i>In Situ</i> Groundwater Treatment with Biological Substrate Injection, Reduced Groundwater Monitoring, and Institutional Controls	Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	2.0	<div></div>		
Alternative GW-3B: <i>In Situ</i> Treatment with ZVI Injection, Reduced Groundwater Monitoring, and Institutional Controls	Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	2.3	<div></div>		
Original ROD: Line Storm Drains, Remove Steam and Fuel Lines, Institutional Controls, and Groundwater Monitoring	Not Protective	Meets ARARs	<div></div>	<div></div>	<div></div>	<div></div>	>10	<div></div>		

Legend:

- Not acceptable
- ◐ Poor
- ◐ Good
- ◐ Very Good
- Excellent

Notes:

- a Overall protection of human health and the environment and compliance with ARARs are threshold criteria and alternatives are judged as either meeting or not meeting the criteria.
- ARAR Applicable or relevant and appropriate requirement
- SVE Soil vapor extraction
- ZVI Zero-valent iron

ATTACHMENT 2

Replacement text discussing institutional controls for Section 4.3.2.1 of draft TMSRA, starting on page 4-15.

Institutional Controls in General

Institutional controls are legal and administrative mechanisms used to implement land use and access restrictions that are used to limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances present on the property, to maintain the integrity of the remedial action until remediation is complete and remediation goals have been achieved, and to assure containment of hazardous substances remaining on the property in vapors, soils or contaminated groundwater after remedial actions have been taken. Institutional controls may remain on a property even after remediation goals have been met in cases where those goals were selected at levels that accounted for the application of institutional controls. Institutional controls would likely remain in place unless the remedial action taken would allow for unrestricted use of the property. Monitoring and inspections are conducted to assure that the land use restrictions are being followed.

Legal mechanisms include proprietary controls such as restrictive covenants, negative easements, equitable servitudes, and deed notices. Administrative mechanisms include notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that may be used to ensure compliance with use restrictions.

The Navy has determined that it will rely upon proprietary controls in the form of environmental restrictive covenants as provided in the "Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control" and attached covenant models (Navy and DTSC 2000) (hereinafter referred to as "Navy/DTSC MOA"). Appendix G contains the Navy/DTSC MOA.

More specifically, land use restrictions will be incorporated into and implemented through two separate legal instruments as provided in the Navy/DTSC MOA:

1. Restrictive covenants included in one or more Quitclaim Deeds from the Navy to the property recipient.
2. Restrictive covenants included in one or more "Covenant to Restrict Use of Property" entered into by the Navy and DTSC as provided in the Navy/DTSC MOA and consistent with the substantive provisions of Cal. Code Regs. tit. 22 § 67391.1.

The "Covenant(s) to Restrict Use of Property" will incorporate the land use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC against future transferees. The Quitclaim Deed(s) will include the identical land use restrictions in environmental restrictive covenants that run with the land and that will be enforceable by the Navy against future transferees.

The "Covenant(s) to Restrict Use of Property" and Deed(s) shall provide that a Parcel B Risk Management Plan ("Parcel B RMP") shall be prepared by the City of San Francisco and approved by the Navy and FFA Signatories. The Parcel B RMP shall be discussed in the Parcel B ROD amendment and shall be attached to and incorporated by reference into the Covenant(s) to Restrict Use of Property and Deed(s) as an enforceable part thereof. It shall specify soil and groundwater management procedures for compliance with the remedy selected in the Parcel B ROD amendment. The Parcel B RMP shall identify the roles of local, state, and federal government in administering the Parcel B RMP and shall include, but not be limited to, procedures for any necessary sampling and analysis requirements, worker health and safety requirements, and any necessary site-specific construction and/or use approvals that may be required.

Land use restrictions will be applied to the property and included in findings of suitability to transfer, findings of suitability for early transfer, "Covenant(s) to Restrict Use of Property" between the Navy and DTSC; and any Quitclaim Deed(s) conveying real property containing Parcel B at HPS.

Access

The Navy and FFA Signatories and their authorized agents, employees, contractors and subcontractors shall have the right to enter upon HPS Parcel B to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain any response or remedial action as required or necessary under the cleanup program, including but not limited to monitoring wells, pumping wells, treatment facilities, and cap/containment systems.

Implementation

The Navy shall address institutional control implementation and maintenance actions including periodic inspections and reporting requirements in the preliminary and final remedial design (RD) reports to be developed and submitted to the FFA Signatories for review pursuant to the FFA (see "Navy Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" attached to January 16, 2004 DoD memorandum titled "Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Record of Decision (ROD) and Post-ROD Policy"). The preliminary and final RD reports are primary documents as provided in Section 7.3 of the FFA.

The process options related to institutional controls will be retained for development and included in the detailed evaluation of remedial alternatives.

Land Use Restrictions:

The following sections describe the institutional control objectives to be achieved through land use and activity restrictions for Parcel B in order to ensure that any necessary measures to protect human health and the environment and the integrity of the remedy have been undertaken.

Restricted Land Uses

The following restricted land uses for property throughout Parcel B at HPS must be reviewed and approved by the FFA Signatories in accordance with the "Covenant(s) to Restrict Use of the Property," Quitclaim Deed(s), and Parcel B RMP prior to use of the property for any of the restricted uses:

- a. A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation,
- b. A hospital for humans,
- c. A school for persons under 21 years of age,
- d. A day care facility for children, or
- e. Any permanently occupied human habitation other than those used for commercial or industrial purposes.

Restricted Activities

The following restricted activities throughout HPS Parcel B must be conducted in accordance with the "Covenant(s) to Restrict Use of Property", Quitclaim Deed(s), and the Parcel B RMP, which will be reviewed and approved by the FFA Signatories:

- a. "Land disturbing activity" which includes but is not limited to: (1) excavation of soil, (2) construction of roads, utilities, facilities, structures, and appurtenances of any kind, (3) demolition or removal of "hardscape" (for example, concrete roadways, parking lots, foundations, and sidewalks) existing at the time of the ROD amendment issuance, and (4) any other activity that involves movement of soil to the surface from below the surface of the land or causes the preferential movement of known contaminated groundwater. Any subsurface intrusive activities that might result in, or facilitate, the movement of contaminated groundwater.
- b. Alteration, disturbance, or removal of any component of a response or cleanup action (including but not limited to pump-and-treat facilities, revetment walls and shoreline protection, and soil cap/containment systems); groundwater extraction, injection, and monitoring wells and associated piping and equipment; or associated utilities.
- c. Extraction of groundwater and installation of new groundwater wells.
- d. Removal of or damage to security features (for example, locks on monitoring wells, survey monuments, fencing, signs, or monitoring equipment and associated pipelines and appurtenances).

Prohibited Activities

The following activities are prohibited throughout HPS Parcel B:

- a. Growing vegetables or fruits in native soil for human consumption.
- b. Use of groundwater.

Additional Land Use Restrictions Relating to VOC Vapors at Specific Locations within Parcel B.

The restricted land uses set forth above must be approved by the FFA Signatories in accordance with the "Covenant to Restrict Use of the Property," Quitclaim Deed, and Parcel B RMP prior to such use of the property within the area requiring institutional controls (ARIC) for VOC vapors in order to ensure that the risks of potential exposures to VOC vapors are reduced to acceptable levels that are adequately protective of human health. Initially, the ARIC will include all of Parcel B. This can be achieved through engineering controls or other design alternatives which meet the specifications set forth in the ROD amendment, RD reports, LUC RD report, and Parcel B RMP. The Parcel B RMP shall provide for adequate soil, vapor, and groundwater sampling and analysis for VOCs. The ARIC may be modified by the FFA Signatories as the soil contamination areas and groundwater contaminant plumes that are producing unacceptable vapor inhalation risks are reduced over time.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne Street
San Francisco, CA 94105

January 12, 2007

Keith Forman
BEC, Hunters Point Shipyard
Department of the Navy, BRAC
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310

RE: Draft Response to Agency Comments on the Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California, December 2006

Dear Keith:

As discussed at our meeting of January 9, 2007, EPA has reviewed the Navy's draft "*Response to Agency Comments on the Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California,*" dated December 2006.

Major issues were discussed on January 9. A more detailed review of the Navy's draft responses is attached.

Please contact me at 415-972-3024 if you have any questions.

Sincerely,

Michael Work
Remedial Project Manager
Superfund Division (SFD-8-3)

cc: (see Distribution List)

Attachment

Distribution List HPS

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**EPA Comments on the
Navy Response to Agency Comments on the Draft Parcel B Technical Memorandum in
Support of a Record of Decision Amendment, Hunters Point Shipyard,
San Francisco, California, December 2006**

Comments are organized by issues identified in the January 9, 2007 meeting; some of these comments may include minor issues not discussed during the meeting. Comments on the Navy's Attachment 1 have been numbered sequentially throughout.

Issue 1: Supporting the need for a ROD Amendment

Response to EPA General Comment 1: The explanations in the response and in Attachment 1 do not clearly explain why a Record of Decision (ROD) amendment is needed. It appears that most of the pieces are included in Attachment 1, but they are scattered throughout the text rather than compiled in one subsection. The text should be expanded to include some additional information to provide support for the need for a ROD amendment. For example, the response does not acknowledge that the extent of contaminated soil could not be found at IR-07 even though numerous step-outs were excavated. Similarly, the percentage by which the actual remedial action (excavation) costs exceeded the costs estimated in the ROD was not stated. In addition, neither the response nor the text acknowledges the finding that trichloroethene was found at concentrations more than an order of magnitude greater than concentrations detected prior to the ROD, which indicates the need for a ROD amendment. Please include this additional material in the Technical Memorandum to Support a ROD Amendment (TMSRA). In addition, please see the comments provided below on Attachment 1.

Comments on New Material in Attachment 1 related to Issue 1

1. **Attachment 1, Executive Summary Update, Page 2 and Section 1.2.2, Groundwater, Page 7:** The last paragraph on page 2 and the first paragraph on page 7 appear to indicate that hexavalent chromium first was detected during the 6 years of Remedial Action Monitoring Plan (RAMP) monitoring, but hexavalent chromium was known to be present in IR10MW12A prior to the issuance of the ROD. Please revise the text of this paragraph to clarify that hexavalent chromium was detected in groundwater prior to RAMP groundwater monitoring.
2. **Attachment 1, Section 1.1, Parcel B CERCLA Process:** The text does not specifically summarize why it was concluded in the five year review that the remedy should be modified. Please revise the text to include this information.
3. **Attachment 1, Section 1.2.2, Groundwater, Page 7:** The proposed text revision does not explain that the VOC plume also is considered to have greater risk because higher concentrations of trichloroethene (TCE) and other chemical constituents were detected after the ROD was signed (i.e., during preparation for the ZVI treatability study). Further, given these higher concentration of VOCs, it is unclear whether the current remedy would comply with Applicable or Relevant and Appropriate Requirements

(ARARs) for vapor inhalation. Please revise the proposed text to include this information.

4. Section 6.3.4, Individual Analysis of Original ROD Groundwater Remediation

Alternative: It is unclear why the text in this section does not reflect the discovery prior to implementation of the zero valent iron (ZVI) treatability study at IR-10 that groundwater contamination was more extensive and present at higher concentrations than previously determined. Please revise the proposed text to include this information.

Issue 2: Mercury in Groundwater at IR-26 and the recent detection in IR26MW49A:

Response to EPA Specific Comments 13 and 64: The response to Specific Comment 13 states that the detection of mercury in a single well does not define a plume, but the recent detection of mercury at the trigger level (0.6 micrograms per liter [ug/L]) in new shoreline well IR26MW49A and above the trigger level in IR26MW47A indicates that there may be a mercury plume during Quarter 27. In addition, mercury has occasionally been detected at low concentrations in IR-26 wells IR26MW46A and IR26MW48A. Although the Navy indicated that mercury is not considered to constitute a plume at IR-26 during the January 9 meeting, we continue to disagree. Therefore, the TMSRA should identify the potential that there is a mercury groundwater plume at IR-26.

Response to EPA Specific Comment 61: The response does not address the comment since the Navy has not demonstrated that the soil and groundwater conditions necessary for adequate adsorption of mercury exist at IR-26. Furthermore, groundwater results for mercury in new IR-26 monitoring well IR26MW49A, where mercury was recently detected at 0.6 ug/L, indicate that these conditions do not appear to exist. In addition, based on Parcel F bathymetric information, the bottom drops off rapidly to the north and east of IR26MW49A; as a result, it appears that groundwater discharges directly through the shoreline rip-rap to the Bay. The TMSRA also concludes that mercury in groundwater poses an ongoing risk to ecological receptors. Therefore, action to reduce the concentration of mercury in groundwater and the mass of mercury being discharged to the Bay is necessary, since monitoring is not a remedy and is not protective of ecological receptors and the Bay. From various responses to Regulatory Agency Comments, it appears that source control by excavation and monitored natural attenuation will be proposed as components of groundwater remedies to address mercury in groundwater at IR-26. Analytical results for total organic carbon (TOC) and humic acids in groundwater to support natural attenuation are needed before the TMSRA is finalized. As suggested by the Regional Water Quality Control Board at the January 9 meeting, amending soil and/or groundwater should be considered for inclusion in the groundwater alternatives, as long as this will not result in production of more toxic forms of mercury. Please provide analytical results for TOC and humic acids to support the interpretation that mercury in groundwater at IR-26 will attenuate through sorption to soil and to support alternatives that involve natural attenuation. If possible, these analyses should be included in the next round of groundwater sampling at IR-26 and the results should be provided in the next version of the TMSRA or as an addendum during the review period so that new alternatives addressing mercury can be evaluated. Please also propose at least two alternatives to minimize or eliminate the discharge of mercury to the Bay; these alternatives

should include both the source removal proposed in other responses and other process options to reduce the concentration of mercury in groundwater to reduce the risk to ecological receptors from the discharge of mercury to the Bay.

Response to EPA Specific Comment 71: The recent detection of mercury in new shoreline monitoring well IR26MW49A indicates that mercury-contaminated groundwater at concentrations that exceed the National Ambient Water Quality Criterion for mercury is likely being discharged to the Bay. The TMSRA also concludes that mercury in groundwater poses an ongoing risk to ecological receptors. Therefore, it appears that Alternative GW-2 is not protective. Please revise the TMSRA to state that GW-2 will not be protective and propose at least two alternatives to address mercury in groundwater.

Issue 3: Metals and HPALs:

Response to EPA General Comment 5: The response indicates that “by definition a portion of the naturally occurring data set will be above the HPALs [Hunters Point Ambient Levels],” but we disagree. We do agree that there is no discrete dividing line between naturally occurring and anthropogenic contributions to metals in soil, but since the HPALs appendices in the original Remedial Investigation Reports indicate that only data collected at depths less than 5 feet below ground surface and data from sites IR-1, IR-2, IR-3, and IR-9 was excluded from the data set, the HPALs do include data from areas subsequently determined to be contaminated with metals, including IR-7, IR-10, IR-18, and IR-26 in Parcel B. Although outliers were excluded when HPALs were calculated, the inclusion of data from all IR sites other than IR-1, IR-2, IR-3, and IR-9 suggests that the data set includes anthropogenic metals. This is one reason why the HPALs were defined as ambient levels, not background, which would represent soil that has not been impacted by humankind. Some historical activities, like sandblasting, likely resulted in windborne dissemination of metals associated with sandblasting over much of Hunters Point, including, but not limited to arsenic, cadmium, copper, lead, mercury, zinc and metals used in ship hulls (e.g., iron, nickel, vanadium, etc.). Spent sandblast materials were also used as fill. Since metals added as antifouling agents were designed to dissolve from paint and hot plastic materials applied to ship hulls to minimize fouling, it is likely that soil beneath areas where spent sandblast materials were used as fill was impacted by metals. The HPALs include samples collected from these areas so the HPALs represent naturally occurring and anthropogenic metals. Therefore, metals concentrations above the HPALs should not be described as naturally occurring unless it is known that the particular metal was not used at Hunters Point in any materials or operations. Please distinguish between metals that were used at Hunters Point and those that are naturally occurring in the text of the TMSRA.

Similarly, the response indicates that Franciscan complex chert contains arsenic, iron and manganese, and that serpentinite contains nickel, it is unclear why the proposed additional text (for Section 2.3.1) indicates that “the widespread distribution of metals remaining in soil is consistent with the concentrations present in native rock.” This has not been demonstrated for all metals and the quoted statement should be removed. Further, since arsenic was used as an antifouling additive and iron, nickel, and manganese are found in steel, it is unlikely that all of

the metals in soil are associated with the use of native rock as fill. Please delete the quoted statement from the proposed text revision.

A definition for and list of ubiquitous metals are needed in the TMSRA, since the responses and text refer to 7 metals, but the response to DTSC Specific Comment 6 lists 20 “ubiquitous” metals. In addition, in some places, including the response to DTSC Specific Comment 2, it appears that “ubiquitous” is used as a synonym for “naturally occurring,” but the list of 20 “ubiquitous” metals includes several that should not be considered naturally occurring because they were known to have been used at Hunters Point. Finally, it is not clear that metals that were not detected above the HPALs or that were rarely detected above the HPALs should be considered “ubiquitous.” Please define “ubiquitous” and list the specific metals that are considered ubiquitous. If “ubiquitous” is synonymous with “naturally occurring,” and this list includes any of the metals used in antifouling paints, in industrial operations, or in materials used on ships (e.g., plating operations, ship hulls, etc), please also explain why it is appropriate to consider anthropogenic metals ubiquitous.

The text addition for the response to this comment that was requested at the January 9, 2007 meeting will be submitted under separate cover after it has been reviewed by all of the Regulatory Agencies.

Response to EPA Specific Comment 35: The response is unclear because it states that that no historical uses of mercury were identified related to activities at Block 16. Mercury was historically used in antifouling paints (*Marine Fouling and Its Prevention*, United States Naval Institute, 1952); therefore, releases of mercury may have occurred from sandblasting, painting, or storage of antifouling paint in the shipwright’s shop. Furthermore, mercury may have been released from switches, gauges, or instruments. Please include storage and sandblasting of antifouling paint; and repair or replacement of switches, gauges, or instruments as possible activities which may have contributed to mercury contamination in soil at IR-26.

Although the response indicates that reports documenting excavation activities were reviewed, it is unclear if the original field notes from the original exploratory excavation (EE-05) were reviewed or if it is possible to interview personnel who supervised excavation at the original EE-05. Since the field notes included in the 1997 *Completion Report, Exploratory Excavations* only summarize activities that took place each day and do not specifically include logs of the excavations, it is possible that additional information was recorded by field personnel supervising excavation at EE-05. If possible, this information should be reviewed before it is concluded that free mercury was not observed during the original EE-05 excavation.

In addition, a written record of the presence of “free mercury” has been found in the Parcel B groundwater reports, which report that free mercury was found during the original EE-05 excavation at IR-26. Please update the response to include this information.

Response to EPA Specific Comment 38: The response partially addresses the comment; see EPA’s Comment to the Navy’s Response to EPA Specific Comment #35 (Issue 3) for possible uses of mercury at IR-26.

Comments on New Material in Attachment 1 related to Issue 3

5. **Attachment 1, Section 1.2.1, Soil, Page 4 and Section 6.5.1, Soil, Page 18:** The text refers to seven metals but only specifies manganese and arsenic. Please list the other five metals in the text.

In addition, since historic Navy documents like *Marine Fouling and Its Prevention*, United States Naval Institute, 1952, indicate that arsenic was used as an antifouling additive to marine paint, and arsenic was also used as a pesticide/rodenticide, it is not appropriate to attribute all of the arsenic detected at Hunters Point to naturally occurring arsenic. Copper, mercury, and zinc were also used as antifouling additives to marine paint, so their presence should also be attributed to shipyard operations. Please revise the text to acknowledge the use of arsenic in anti-fouling paints, its potential presence associated with spent sand blast abrasives, and its possible use as a pesticide/rodenticide. In addition, please discuss the use of copper, mercury, and zinc as antifouling additives.

Issue 4: Asbestos in IR-26 soil and the need to vegetate/cover bare dirt:

Response to EPA Specific Comment 56: Given the presence of asbestos in soil from IR-26 found during the SD/SS TCRA, ensuring that areas with bare soil are revegetated is necessary to reduce potential exposure to wind-blown dust that may contain asbestos. Please revise Alternatives S-2 and S-3 to include vegetating areas with bare soil.

Issue 5: Ranking of Alternatives:

Response to EPA Specific Comment 59 (ranking of alternatives): Since the text in the bullets indicates that it may be difficult to excavate below the groundwater table, it is unclear if the rankings for Implementability of Alternatives S-2 through S-5 should be updated to reflect this expected technical difficulty. For example, the response indicates that “[excavation of mercury source material] at depths significantly below the groundwater table would be difficult because of dewatering considerations and may not be feasible because of the immediate proximity of the Bay.” Implementability of these alternatives (rated as very good) was unchanged. Please include a discussion of the expected difficulties for excavation below the water table in Sections 6.1.2.6, 6.1.3.6, 6.1.4.6 and 6.1.5.6, and if appropriate, reduce the Implementability rating of these alternatives from very good to good.

Further, it appears that the protectiveness and short-term effectiveness rating of Alternatives GW-2, GW-3A and GW-3B should be downgraded. The detection of mercury at the trigger level (0.6 ug/L) in new shoreline monitoring well IR26MW49A indicates that mercury is likely being discharged in groundwater to San Francisco Bay. Hence, it appears unlikely that the current mass of mercury in groundwater will attenuate; it is likely that mercury will continue to be discharged to the Bay at concentration greater than the National Ambient Water Quality

Criterion (NAWQC). Please revise Sections 6.3.2.5 and 6.3.3.5 to indicate that the current mass of mercury in groundwater does not appear to be attenuating before groundwater is discharged to the Bay. Please also reduce the short-term effectiveness rating for Alternatives GW-2, -3A and -3B from very good to good, and adjust the overall ratings accordingly or revise these alternatives to include process options to address both the source of mercury and to minimize discharge of mercury to the Bay.

Response to EPA Specific Comments 51, 63, and 73: Vinyl chloride continues to be produced at IR-10 at concentrations ranging up to 81 ug/L. Samples collected from some wells that did not previously have vinyl chloride or that did not have this constituent for several years prior to the ZVI treatability study, like IR10MW13A1 and IR10MW33A, now have vinyl chloride at concentrations ranging up to 2.7 ug/L. In addition, vinyl chloride is still being produced in the vicinity of the anaerobic/aerobic treatability study area in RU-C5, which is adjacent to Parcel B. For example, vinyl chloride was detected in study wells at the end of the treatability study (e.g., IR25MW53A, IR25MW54A, and recently has been detected at concentrations ranging from 1.8 to 4.7 ug/L in IR25MW52A, which is on the edge of the treatability study area. Therefore, it appears that vinyl chloride would likely be produced in the short-term time-frame under either Alternatives GW-3A or GW-3B. Since Alternative 3A does not include an aerobic degradation phase and vinyl chloride degrades more easily under aerobic conditions than under anaerobic conditions, it is possible that more vinyl chloride would be produced under GW-3A than under GW-3B. Therefore, the short-term effectiveness rankings for both alternatives should reflect the toxicity of vinyl chloride. Please revise the short-term effectiveness rankings for both alternatives and revise the text of the TMSRA to state that vinyl chloride may be produced as an intermediate product.

Response to EPA Specific Comment 63: The response appears to address the comment; however, it is not clear why the long-term effectiveness and performance rating for Alternative GW-3B was reduced from excellent to very good. The Navy has maintained that ZVI is an effective treatment on all of the volatile organic compounds (VOCs) in groundwater at Parcel B; therefore, it is not clear why Alternative GW-3A should be ranked higher than Alternative GW-3B for long-term effectiveness and performance. Please explain this change or restore the original ranking.

Response to EPA Specific Comment 71 (repeated from Issue 2): : The recent detection of mercury in new shoreline monitoring well IR26MW49A indicates that mercury-contaminated groundwater at concentrations that exceed the National Ambient Water Quality Criterion for mercury is likely being discharged to the Bay. The TMSRA also concludes that mercury in groundwater poses an ongoing risk to ecological receptors. Therefore, it appears that Alternative GW-2 is not protective. Please revise the TMSRA to state that GW-2 will not be protective and propose at least two alternatives to address mercury in groundwater.

Comments on New Material in Attachment 1 related to Issue 5

6. **Attachment 1, Section 1.2.1, Soil, Page 6 and Section 6.1.6.5, Short-Term Effectiveness, Original ROD Soil Alternative:** It is not clear why implementation over a period of 31 months is considered “poor” for short-term effectiveness, when excavation

is not being done at present for the current remedy. It is unclear if the 31 month period includes the time when excavation was stopped to allow preparation of the Explanation of Significant Differences (ESD). Please revise the text to explain why the current remedy is ranked poor for short-term effectiveness. In addition, please clarify if excavation was stopped while the ESD was prepared and approved.

7. **Table 6-2, Ranking of Remedial Alternatives for Soil and Groundwater:** The difference between the alternatives is not adequately represented. For example, Alternatives S-2 and S-3 were scored the same except for cost, but the overall rating is still the same. The addition of excavation and methane and mercury source removal to S-3 should mean that S-3 is considered more protective and more effective than S-2, which only includes institutional controls and shoreline revetment. This should be reflected in the ranking.

For groundwater, it is unclear why Alternative GW-3B, which involves ZVI injection is considered less effective than GW-3A, which involves biological substrate injection. Both options appear to produce vinyl chloride. This needs to be clarified.

In addition, the overall rating for Alternative S-2 is not consistent between Section 6.2.8 of Attachment 1 and Table 6-2 of Attachment 1. Please resolve these discrepancies.

Costing:

Response to Appendix D Comment 1: It is unclear why the response indicates that costs leading to transfer like the Finding of Suitability to Transfer (FOST) should be included in the TMSRA. The only costs that should be included in a Feasibility Study, Proposed Plan, or ROD are those that will be incurred for remedial design, remedial action, operations and maintenance, etc. Basically, these costs are those associated with the remedy. Please see EPA Guidance document, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, EPA 540-R-00-002, July 2000. A FOST is not considered part of the remedy, so costs for a FOST should not be included in the TMSRA. In addition, those costs do not change from remedy to remedy, so removal of the FOST costs will not change how the alternatives are evaluated. Please revise the TMSRA to delete all costs for the FOST. (We note that this may conflict with a portion of the response to City and County of San Francisco Comment 39).

Comments on Issues not discussed at the January 9 meeting:

Response to EPA Specific Comment 4: The response partially addresses the comment and the inclusion of 2006 data is appreciated; however, it is not sufficient only to discuss the most recent data. The maximum concentration detected after December 2004 should also be discussed to update the discussion of the maximum concentrations used in Human Health Risk Assessment (HHRA). For example, hexavalent chromium (Cr^{+6}) was reported at 680 ug/L at IR10MW12A in December 2005; according to Page 1151 of Table A8 of the TMSRA, the highest concentration of Cr^{+6} at IR10MW12A used for the HHRA is 550 ug/L, reported in March 2004.

This is important because the most recent concentration of Cr^{+6} is 487 ug/l, which is less than the concentration used in the HHRA. Please revise the text of the TMSRA to also include the maximum concentration detected since December 2004 (i.e., since the cutoff date for data inclusion in the HHRA).

Response to EPA Specific Comment 6: The response partially addresses the comment; however, the interpretation that the full extent of the A-Aquifer in the area around well IR10MW12A was characterized during the Cr^{+6} Investigation is not supported by the depiction of hydrogeologic units on Figure 2-4 of the TMSRA. According Cross-section B-B' of Figure 2-4, the A-Aquifer extends about 30 feet below ground surface (ft bgs) in the vicinity of IR10MW12A; therefore, it appears that the shallow portion of the A-Aquifer was characterized during the Cr^{+6} Investigation. Furthermore, Cr^{+6} was recently reported at 0.35 ug/L in downgradient well PA50MW01A, which may indicate that the extent of Cr^{+6} was not adequately characterized during the Cr^{+6} Investigation.

In addition, the proposed revision to Section 2.1.3.2 indicates that clay was encountered beneath the A-Aquifer in the borings of the Cr^{+6} Investigation; however, the total depth of these borings (i.e., from 12-15 ft bgs) are above the bottom of the A-Aquifer. Please revise the proposed text revision to indicate that the A-Aquifer was characterized to 15 feet bgs in the vicinity of IR10MW12A, and delete the statement that clay was encountered below the A-Aquifer in the borings of the Cr^{+6} Investigation.

Response to EPA Specific Comment 15: The response does not adequately address the comment since releases of Cr^{+6} from the storm drain or sanitary sewer (SD/SS) lines were not included as potential Cr^{+6} sources. Monitoring well IR10MW12A is located near a sanitary sewer line and industrial wastes are known to have been discharged to the SD/SS lines, according to the Parcel B Remedial Investigation (RI) Report. If the SD/SS lines were the source, it is possible that the SD/SS time-critical removal action (TCRA) will remove all or part of the source area. Please revise Section 2.3.2 to indicate that possible sources of Cr^{+6} also include releases from leaking sewer lines.

Response to EPA Specific Comment 29: The response partially addresses the comment, but possible contamination associated with the former machine shop and torpedo maintenance at Building 113 was not identified. Please identify the former machine shop as a possible source of contamination.

Response to EPA Specific Comment 31: The response does not adequately address the comment because the highest Cr^{+6} concentration detected, 680 ug/L, will not be included in the text. Since this concentration exceeds the maximum concentration used in the HHRA and the most recent concentration, 487 ug/L, does not, the maximum concentration detected after the HHRA data set cut off should be discussed in the text of the TMSRA. Please include the maximum Cr^{+6} concentration, 680 ug/L, in the text of Section 3.4.8.

Response to EPA Specific Comment 36: The response does not adequately address the comment since the text was not revised to indicate the measured concentrations of copper and zinc exceeding their Explanation of Significant Differences (ESD) Clean-up Levels (160

milligrams per kilogram [mg/kg] and 370 mg/kg, respectively) were not delineated at 3 ft bgs. According to Fuel Line F Figures A and B of the Construction Summary Report, dated November 2002 (the CSR), copper and zinc were reported in bottom 5-point composite samples collected at 3 ft bgs at concentrations ranging up to 2,850 mg/kg and 1,190 mg/kg, respectively. Sidewall samples were not collected at 3 ft bgs near locations that exceeded ESD Clean-Up Levels; therefore the extent of copper and zinc was not adequately delineated at 3 ft bgs, given that stratification of fill layers is expected in IR-07, based on the new site conceptual model with layers of contaminated fill rather than surface releases. As a result, it appears that the HHRA likely underestimated the total risk for soil in Block BOS-1 since bottom 5-point composite soil samples exceeding ESD Clean-Up Levels were removed, while adjacent soils were not adequately characterized. Please revise Section 3.4.13 and the uncertainty analysis in the HHRA to incorporate this information.

Response to EPA Specific Comment 45: The response appears to address the comment, but the argument would be strengthened if the difference in excavation depths were included. It appears that the excavation for the revetment would be shallower than excavation to remove contamination. Please consider the suggested revised text for the TMSRA to include a discussion of the difference in excavation depths necessary for contaminant remediation and the revetment.

Response to EPA Specific Comment 59 (confirmation sampling): The response partially addresses the comment; however, it is unclear if limiting the depth of excavation to 15 ft bgs and not delineating the horizontal extent of mercury contamination would be sufficient to remove the mercury source. If mercury was released as a surface spill, then it would not be necessary to delineate the horizontal extent of mercury contamination further, unless the bedrock surface is found to be sloped (i.e., elemental mercury would behave like a dense nonaqueous phase liquid). However, if mercury is associated with the use of contaminated fill, then sidewall samples from depths at and below 10 ft bgs to confirm that sufficient soil has been removed should be collected and analyzed. Since the release mechanism appears to be unknown, sidewall samples should be collected. Please discuss the conceptual model for mercury release or use of contaminated fill and include sidewall samples in the remedial action.

Comments on Navy Responses to EPA Comments on Appendix E, Beneficial Use Evaluation for Parcel B Groundwater.

Response to EPA General Comment 1: The response addresses the comment; however, there is a discrepancy between the description of the thickness of the B-Aquifer in the proposed revision in bullet 5, and the depicted depth on Figure 5 of the B-Aquifer Tech Memo (the B TM). Figure 5 of the B TM indicates that the B-Aquifer is at least 30 feet in portions of the central and western areas of Parcel B; however, the proposed text revision indicates that B-Aquifer thickness ranges from 5 to 15 feet thick. Please resolve this discrepancy.

Response to EPA Specific Comment 1: It appears that the intent of the comment was misunderstood. An objective of USEPA's Groundwater Protection Strategy is to protect groundwater which may prove viable as a source of water in the future. The evaluation

of the availability of groundwater from B-Aquifer should not be based on the current number of B-Aquifer monitoring wells; the Navy has indicated that additional wells may be installed in the B-Aquifer as part of the Remedial Action and additional wells could be installed as an emergency measure after a catastrophic earthquake. Please revise the Section E2 to consider use of the B-Aquifer regardless of the current nu



Linda S. Adams
Secretary for
Environmental Protection



Department of Toxic Substances Control

Maureen F. Gorsen, Director
700 Heinz Avenue
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Arnold Schwarzenegger
Governor

March 6, 2007

Department of the Navy
Base Realignment and Closure
Program Management Office West
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San Diego, CA 92108-4310
Attention: Keith Forman

**RESPONSE TO COMMENTS ON THE DRAFT PARCEL B TECHNICAL
MEMORANDUM IN SUPPORT OF RECORD OF DECISION AMENDMENT, HUNTERS
POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA**

Dear Mr. Forman:

The Department of Toxic Substances Control, Human and Ecological Risk Division has reviewed the Navy's Response to Comments (RTC) on the Draft Parcel B Technical Memorandum in Support of Record of Decision Amendment. This review focused on Navy's RTC on the human health and ecological risk issues of the draft document. These comments are attached.

If you have any questions regarding these comments please call me at 510-540-3776.

Sincerely,

Thomas P. Lanphar
Senior Hazardous Substance Scientist
Office Military Facilities
Department of Toxic Substances Control

cc: See next page.

Mr. Keith Forman
March 6, 2007
Page 2

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Ms. Barbara Bushnell
Hunters Point Restoration Advisory Board
RAB Co-Chair

Dr. Jim Polisini
DTSC, HERD

Ms. Melanie Kito
US Navy



Mr. Keith Forman
March 6, 2007
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Mr. Ralph Pearce
US Navy



Linda S. Adams
Secretary for
Environmental Protection



Department of Toxic Substances Control



Arnold Schwarzenegger
Governor

Maureen F. Gorsen, Director
1011 North Grandview Avenue
Glendale, California 91201

MEMORANDUM

TO: Tom Lanphar, DTSC Project Manager
OMF Berkeley Office
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FROM: James M. Polisini, Ph.D.
Staff Toxicologist, HERD
1011 North Grandview Avenue
Glendale, CA 91201

DATE: February 14, 2007

SUBJECT: RESPONSE TO COMMENTS ON TECHNICAL MEMORANDUM
IN SUPPORT OF RECORD OF DECISION AMENDMENT FOR
PARCEL B AT HUNTERS POINT SHIPYARD
[SITE 200050-18 PCA 18040 H:14]

BACKGROUND

HERD reviewed the document titled *Navy Response to Agency Comments on the Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California*, dated December 8, 2006. This document was prepared by SulTech, A Joint Venture of Sullivan Consulting Group and Tetra Tech EM, Inc., of San Diego, California.

This Response to Comments (RTC) addresses HERD comments on the document titled *Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment (TMSRA), Hunters Point Shipyard, San Francisco, California* dated March 28, 2006. The HERD memorandum was dated June 19, 2006. HERD commented on both the Human Health Risk Assessment (HHRA) and the Ecological Risk Assessment (ERA) in the June 19, 2006 memorandum.

Hunters Point Shipyard (HPSY) is situated on a promontory in the southwestern portion of San Francisco Bay. HPS is bounded on the north and east by San Francisco Bay and on the south and west by the Bayview Hunters Point district of San Francisco. The area within the property boundaries is approximately 955 acres of which approximately

400 acres are offshore sediments. These offshore sediments are designated Parcel F.

GENERAL COMMENTS

Over 100 pages of Navy responses were provided to agency, department and board comments to the Draft Technical Memorandum for a ROD Amendment. HERD's primary risk assessment requirement is that the HHRA contain a presentation of summed risk and/or hazard from exposure to both soil and groundwater and that the ERA describe the location and concentration of sediment samples with potential contaminants between the National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) and Effects Range-Median (ER-M).

HERD has briefly reviewed the comments made by other agencies, departments and boards and supports those comments.

SPECIFIC COMMENTS

1. HERD Specific Comment number 1 (HHRA). HERD commented that any amendment to the Record of Decision (ROD) be delayed until the estimate of the human health risk associated with radiological contaminants was completed. This delay is necessary to allow a human health risk estimate summed for chemical exposure and radiological exposure. The response agrees that the amendment cannot be completed without an evaluation of human health risk from radiological contaminants, but indicates the radiological evaluation is on-going and will be included at a later date in an addendum to the Technical Memorandum in Support of a ROD Amendment (TMSRA). This requirement has not been completed and, therefore, review of the TMSRA HHRA cannot be completed at this time.
2. HERD Specific Comment number 3 (HHRA). HERD meant the term 'hot spot' at the end of this comment to refer to grid units with elevated human health risk and/or hazard, not necessarily locations with extremely elevated concentrations in soil or groundwater. The unfortunate use of the term 'hot spot' appears to have misrepresented the point of the comment. HERD continues to recommend that risk managers closely evaluate projected use (e.g., residential use) of grid units with few or no sample data which are adjacent to sample grids with elevated human health risk and/or hazard. This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractors.
3. HERD Specific Comment number 7 (HHRA). The response adequately answers the comment regarding the use of an Air Change per Hour (ACH) rate of 100 rather than 2. The site-specific information from 340 HPSY excavations, of more than 40,000 linear feet, provided in the response must be referenced in the appropriate text and tables for the Construction Work Trench Exposure scenario in support of the Air Change per Hour rate of 100.

4. HERD Specific Comment number 11 (HHRA). The response is unacceptable. Presentation of human health risk and/or hazard separately for each exposure medium (i.e., soil and groundwater) does not provide all the risk assessment information required in the HHRA. If HERD comments were taken to mean agreement to separate presentation, in the referenced October 2004 Base Closure Team (BCT) meeting, the intent was to provide the media-specific presentation of human health risk and/or hazard in addition to the presentation of the total risk and/or hazard from exposure for all scenario-specific exposure pathways. For example, as a portion of the Parcel B A-Aquifer groundwater has been de-designated as a domestic water supply source by the San Francisco Regional Water Quality Control Board (SFRWQCB), the only residential exposure route in the areas de-designated would be indoor air. The total risk and/or hazard would then include soil exposure pathways in addition to indoor air exposure pathways. At a minimum, a table which presents the human health risk and/or hazard from exposure to all applicable media must be included, and risk and hazard noted in the text. In the event Parcel B-wide Institutional Controls (ICs) to control migration of Volatile Organic Compounds (VOCs) to indoor air are proposed, the indoor air exposure can be removed from the estimate of future risk and/or hazard in that discussion after the total risk and/or hazard for all applicable pathways is presented.
5. HERD Specific Comment number 12 (HHRA). HERD accepts the response, contained in the referenced response to EPA Region 9 comment number 21, that the HHRA will be revised to include evaluation of mercury inhalation from groundwater volatilization in the residential, industrial and construction work scenario. The response to EPA Region 9 comment number 21, however, states that plume-based exposure areas will not be re-delineated based on the results of the mercury inhalation assessment. HERD disagrees. Hazard quotients in excess of 1 for mercury inhalation exposure are cause to re-delineate plume-based exposure units.
6. HERD Specific Comment number 14 (ERA). The response indicates that comparison of Parcel B intertidal sediment concentrations need not be compared to NOAA ER-L concentrations in addition to NOAA ER-M concentrations to identify Contaminants of Potential Ecological Concern (COPECs) as the proposed remedial alternative is placement of a revetment along the entire shoreline which would be protective regardless of the number of COPECs. While ecological exposure pathways will be broken if the revetment addresses the location and physical transport characteristics of all COPECs, this cannot be determined without adequately addressing the full range of COPECs and their location within the intertidal zone. The NOAA ER-L comparison can be added to a table in the ERA, while the evaluation of remedial alternatives remains based on the ER-M comparison. Once a remedial alternative is selected (e.g., a revetment), the location and concentration of the additional sediment concentrations between the ER-L

concentration and the ER-M concentration should be reviewed when evaluating any location (e.g., revetment to mean water level or mean lower low tide) and/or design (e.g., sand, riprap and gravel or elastomeric barrier and riprap) of the remedial alternative. This same strategy would address HERD Specific Comment number 18 and the response.

7. HERD Specific Comment number 16 (ERA). The disagreement on field-collected versus laboratory (*Macoma nasuta*) derived Bioaccumulation Factors (BAFs) is not that the correlation between tissue concentrations and sediment concentrations was closer for laboratory-derived than for field-collected tissues. Nor is the disagreement that depurated polychaete tissue showed lower bioaccumulation, on a normalized lipid basis, than either amphipods or bivalves. The ERA issue is that BAFs for some inorganic elements were higher in field-collected polychaete tissue than for laboratory-derived BAFs and that, during development to the South Basin work plan, the Navy agreed to use the most protective BAF in ERA calculations. The response should be amended to add that while field-collected BAFs for inorganic elements may be slightly more protective, the correlation of laboratory-derived BAFs to sediment concentration is much higher, and therefore provides more reliable identification of the sediment areas requiring consideration for remedial alternatives. This amendment and the additional material to be added in response to HERD Specific Comment 21 will provide a more complete rationale for selecting laboratory-derived BAFs.
8. HERD Specific Comment number 19 (ERA). HERD takes the referenced response to DTSC (Lanphar) comment 40 to mean that the actual comparisons of groundwater concentrations to groundwater ecological screening concentrations will be presented rather than relying on statements in the text regarding frequency of detection in the selection of groundwater COPECs. This is acceptable. HERD supports DTSC comment number 40 (Lanphar) and the list of groundwater COPECs to be retained.
9. HERD Conclusion Comment number 1 (b). The DTSC Project Manager should be aware that the Exposure Point Concentration (EPC) for soil is calculated in a somewhat different manner than the EPC for groundwater. Associated with this difference in methodology are the differences in treatment of soil and groundwater sample results to develop the data base used to calculate the EPC outlined in EPA Region 9 Comment on Appendix A, the Parcel B HHRA. HERD supports the EPA Region 9 General Comment 2 on Appendix A.
10. HERD Conclusion Comment number 1 (e). Separate presentations of risk and/or non-carcinogenic hazard for soil and groundwater provide an incomplete picture of human health risk and/or hazard. The human health risk and/or hazard based on total exposure must be presented.

Tom Lanphar
February 14, 2007
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CONCLUSIONS

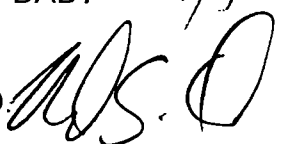
The sheer volume of the RTC document at 109 pages indicates there are significant issues to be addressed and revisions to be made before the Technical Memorandum provides the information sufficient for consideration of an amendment to the Parcel B ROD. We look forward to working with the other agencies, departments, boards and resource trustees as well as the Navy in resolving all the issues commented upon.

REFERENCES

Department of Toxic Substances Control (DTSC). 2005. Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air. December 15, 2004 (Revised February 7, 2005)

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Michael Anderson, Ph.D.
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February 14, 2007
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C:\Risk\HPSY\Parcel B RTC Tech Memo Supporting Amendment to ROD.doc H:14
DOR:12/13/2006 RCD:None DOF: 2/14/2007

For Discussion at 10907 RTC to Parcel B TMSRA meeting

Major Comments on the RTC to the TMSRA

1. Restricted Land Uses

The language proposed in Attachment 2 for the Restricted Land Uses (page3) that requires all residential land uses to be “reviewed and approved by FFA Signatories” contradicts the language in the Conveyance Agreement that requires the Navy to provide Parcel B to the City in a condition that permits the use of the Parcel in a manner that is materially consistent with the use of the Parcel as such use is set forth in the Redevelopment Plan. The Redevelopment Plan provides for residential uses on Parcel B. Requiring the transferee to obtain regulatory approval to build any residential use does not satisfy the Conveyance Agreement.

To satisfy the requirements of the Conveyance Agreement, the Navy could:

- a. Change this language to make constructing residential uses a permitted activity at the time of transfer. Specifically, the FFA signatories must have reviewed and approved any environmental restrictions and covenants placed on the property and those documents must permit the use of the property for residential use at the time of transfer. Requiring future regulatory approvals before residential uses can be constructed on Parcel B does not satisfy this requirement.
- b. Select a different remedy so that this review and approve clause can be removed.
- c. Prove that it is technically impracticable (as defined by CERCLA) to allow residential uses on Parcel B. This is the only exception allowed in the Conveyance Agreement to the requirement that the Navy deliver the property to the Redevelopment Agency in a condition that allows for the uses in the Redevelopment Plan.

2. Risk Management Plan (RMP) details

- a. RMP is part of the remedy and a Navy responsibility. As listed in the RTC in many sections, the RMP is an integral part of the remedy. As an enforceable piece of the remedy, it is the Navy's responsibility to prepare and get approvals of the RMP. The City/SFRA/Lennar are not responsible for remediating the property and the regulators cannot impose remediation requirements on these entities. The City/SFRA/Lennar are willing to provide major assistance in preparing the RMP and already have prepared an outline of the contents of the RMP for the Navy's consideration. However, the RMP itself and the documents describing the RMP need to reflect that it is a Navy document and an enforceable piece of the remedy.
- b. Requirements for sampling as detailed in the RMP. The Navy's remedy must be based on sufficient data about site conditions to provide the regulators and the public with confidence that the remedy adequately addresses site conditions. We believe there are only two instances where sampling should be required in the RMP:

1. When there is visual or olfactory evidence that some previously unknown problem has been discovered (e.g. an underground tank, odors encountered during subsurface disturbance, evidence of liquid waste etc.)
 2. When it is necessary to characterize soil or groundwater under applicable laws for offsite disposal purposes.
- c. Notification requirements. We agree that the RMP will spell out notice requirements applicable during the redevelopment process. We expect that the notice requirements will provide for notifications to DTSC and possibly other FFA signatories when SFRA/Lennar or other developers are conducting actions listed in the RMP (removing covers, replacing covers, digging in identified groundwater plumes etc,). We also understand that the deed, covenant and RMP together will provide for DTSC and other FFA signatories to use their inspection and enforcement authorities to enforce environmental restrictions, including stopping work if it is not being done in accordance with the environmental restrictions. However, a notification process is not a pre-development approval process. As stated, environmental restrictions that require approval from regulatory agencies to construct residential development do not satisfy the terms of the Conveyance Agreement.
- d. Process for addressing unknowns. If an unknown problem is discovered (underground tank, petroleum contamination) then City/SFRA/Lennar will automatically be obligated under existing laws and regulations to notify and work with regulatory agencies (e.g. DPH/LOP, RWQCB) to deal with these issues. In addition, SFRA/Lennar would ask the Navy to come back and deal with these issues.

3. Vapor Barriers

- a. The RTC assumes that vapor barriers are required for all existing buildings. How is the remedy complete without the installation of vapor barriers in existing buildings? For an acceptable remedy, the Navy needs to:
1. install the barriers in the existing buildings, or
 2. demolish the existing the buildings to remove the hazard, or
 3. Further analyze whether there really is a risk in all of Parcel B (we agree that the TMSRA does demonstrate that the buildings on top of the VOC groundwater plumes need vapor barriers). To the extent there is a need for vapor barriers in new structures, this is a potential substantial institutional control cost that should be included in the cost of the remedy and not automatically borne by future property owners.

Other Comments:

1. If vapor barriers are not required everywhere – just over VOC groundwater plumes – there needs to be an agreed process for reducing the size of the vapor barriers (reducing the size of ARIC – end of attachment 2)
2. Conclusion that IR-10 chromium plume does not need to be remediated: we would like to discuss whether this conclusion is based on the size and/or concentration magnitude?
3. Need discussions with regulators on what is required for the deed restrictions to work, for instance, are signs alone enough to restrict access? Agreement on what is required to make restrictions work impacts the costs that Navy includes in TMSRA.
4. Separate meetings with BCT about RMP and spelling out the details to make everyone comfortable

APPENDIX L
RESPONSES TO REGULATORY AGENCY COMMENTS ON THE
DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A
RECORD OF DECISION AMENDMENT

TABLE L-1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the U.S. Environmental Protection Agency (EPA) on the “Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard [HPS], San Francisco, California,” dated June 22, 2007. Comments were submitted by Mark Ripperda (EPA) on July 18, 2007. Additional comments were submitted by Mr. Ripperda on July 25, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the draft final TMSRA, even though some of these numbers have changed in the final TMSRA.

No.	Page	Comment	Response
Comments on Responses to Comments on the Draft TMSRA			
GC 1.	---	Response to General Comment 1 and revised text in the Executive Summary and Section 1.2.1, Soil: The Technical Memorandum in Support of a Record of Decision Amendment (the DF TMSRA) should acknowledge that contaminated fill was used to build portions of the shipyard or that former Navy activities resulted in release of contaminants. The text only acknowledges that “there is a potential that some metals have sources other than naturally occurring materials.” It should not be concluded that when the distribution of samples with elevated metals concentration is not indicative of a “spill” that the elevated metals concentrations can be considered “ubiquitous” or naturally occurring. For example, metals contamination associated with use of spent sandblast grit as fill materials would not have the characteristics of a “spill,” but the resulting contamination is the result of former Navy activities. Please revise the text to acknowledge the use of contaminated fill to construct portions of the shipyard.	<ul style="list-style-type: none"> The Navy agrees that former Navy activities have resulted in releases of contaminants at Parcel B. The Navy has worked to remove these sources during the remedial actions taken to date. These sources include spent sandblast grit. However, the Navy disagrees with the characterization that the fill used to construct Parcel B is, in general, contaminated. Furthermore, field observations of spent sandblast grit at Installation Restoration (IR) Site 07 indicate the disposal of this material exhibited the characteristics of a spill; that is, the sandblast grit was found in a single location (as might have been dumped from a truck) and was not distributed or intermixed with fill on a more widespread basis. The Navy has removed sandblast grit from locations where this material was observed and where chemical concentrations exceeded cleanup goals. The report was not changed as a result of this comment.
SC 4.	---	Response to SC 4: The response indicates the text of Section A9.0 will be expanded to include a brief discussion of the qualitative evaluation of the data collected after November 2004 and the minimal effect on risk assessment results. This information could not be located in Section A9.0. Please modify Section A9.0 as indicated in the response, or provide the reference to the evaluation of the impact of data collected after November 2004 on the human health risk assessment (HHRA).	<ul style="list-style-type: none"> The evaluation of the effect of more recent (post-November 2004) concentrations in groundwater on the results of the HHRA was inadvertently excluded from Section A9.0. Section A9.0 has been revised to include this evaluation. The evaluation consisted of review of nine additional quarters of groundwater monitoring results for Parcel B (January 2005 through March 2007), as reported in quarterly sampling reports (Kleinfelder 2006a, 2006b, 2006c, and CE2 and Kleinfelder 2006, 2007a, 2007b, 2007c, 2007d, 2007e). Detected results from this sampling period were compared with the groundwater risk-based screening levels for vapor intrusion (VI-RBSL) developed for Parcel B (listed in Table A-13 in Appendix A of the TMSRA). This evaluation showed that the results for trichloroethene (TCE) and vinyl chloride at

TABLE L-1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
SC 4. (cont.)	---	(see above)	<p>the IR-10A plume-based exposure area, chloroform at grid A108, dichlorofluoromethane at grid B4516, and mercury at grid AY02 exceeded VI-RBSLs. In addition, methyl acetate was detected in samples collected at grid AJ07. Further evaluation of these findings indicated the following:</p> <ul style="list-style-type: none"> - <u>TCE at the IR-10A plume</u>: The subsequent analytical results for TCE from the January 2005 to March 2007 sampling period do not affect the status of this chemical as a chemical of concern (COC); that is, more recent data show that TCE would remain a COC for the IR-10A exposure area because the maximum concentration continues to exceed the residential VI-RBSL. Thirty-four samples collected from five monitoring wells exceeded the residential VI-RBSL for TCE of 2.9 micrograms per liter (µg/L). The planned reuse associated with the redevelopment blocks encompassed by the IR-10A plume-based exposure area is mixed use, and the residential VI-RBSL was used to evaluate analytical results. Based on analytical results from January 2005 to March 2007, the maximum detected concentration of TCE was 270 µg/L at well IR10MW71A. This concentration is less than the maximum concentration of TCE at IR-10A evaluated in the HHRA of 610 µg/L. - <u>Vinyl chloride at the IR-10A plume</u>: The subsequent analytical results for vinyl chloride from the January 2005 to March 2007 sampling period do not affect the status of this chemical as a COC; that is, more recent data show that vinyl chloride would remain a COC for the IR-10A exposure area because the maximum concentration continues to exceed the residential VI-RBSL. Twenty-nine samples collected from four monitoring wells exceeded the residential VI-RBSL for vinyl chloride of 0.29 µg/L. As discussed above for TCE, the residential VI-RBSL was used to evaluate vinyl chloride for the IR-10A exposure area. Based on analytical results from January 2005 to March 2007, the maximum detected concentration of vinyl chloride was 81 µg/L at well IR10MW61A. This concentration is less than the maximum concentration of vinyl chloride at IR-10A evaluated in the HHRA of 170 µg/L.

TABLE L-1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
SC 4. (cont.)	---	(see above)	<ul style="list-style-type: none"> <li>– <u>Chloroform at grid A108</u>: The subsequent analytical results for chloroform from the January 2005 to March 2007 sampling period do not affect the results of the HHRA. The result (1.4 µg/L) for one sample collected from a single monitoring well (IR07MW26A) exceeded the residential VI-RBSL for chloroform of 0.70 µg/L. However, the planned reuse associated with the location of grid A108 is open space (recreational). As discussed in Section A3.5.2, groundwater exposure pathways are incomplete for recreational receptors, and recreational risks from exposure to groundwater were not evaluated for grid A108 in the HHRA as a result. Therefore, recreational health risks are not associated with exposure to groundwater at grid A108, regardless of analytical results. <li>– <u>Dichlorofluoromethane at grid B4516</u>: The subsequent results for dichlorofluoromethane from the January 2005 to March 2007 sampling period do not affect the status of this chemical as a COC; that is, more recent data show that dichlorofluoromethane would remain a COC for grid B4516 because the maximum concentration continues to exceed the residential VI-RBSL. Four samples collected from a single monitoring well exceeded the residential VI-RBSL for dichlorofluoromethane of 14.3 µg/L. The planned reuse associated with the location of grid B4516 is mixed use, and the residential VI-RBSL was used to evaluate analytical results. Based on analytical results from January 2005 to March 2007, the maximum detected concentration of dichlorofluoromethane was 26 µg/L at well IR26MW41A. This concentration is less than the maximum concentration of dichlorofluoromethane at grid B4516 evaluated in the HHRA of 59 µg/L. <li>– <u>Mercury at grid AY02</u>: The subsequent analytical results for mercury from the January 2005 to March 2007 sampling period do not affect the results of the HHRA. Seven samples collected from two monitoring wells (IR26MW47A and IR26MW49A) exceeded the residential VI-RBSL for mercury of 0.68 µg/L. The maximum detected concentration of mercury from these two samples was 1.7 µg/L at well IR26MW47A. However, the planned reuse associated with the location of grid AY02 is open space (recreational).

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No.	Page	Comment	Response
SC 4. (cont.)	---	(see above)	<p>As discussed in Section A3.5.2, groundwater exposure pathways are incomplete for recreational receptors, and recreational risks from exposure to groundwater were not evaluated for grid AY02 in the HHRA as a result. Therefore, health risks are not associated with exposure to groundwater at grid AY02, regardless of analytical results.</p> <ul style="list-style-type: none"> - <u>Methyl acetate at grid AJ07</u>: The subsequent analytical results for chloroform from the January 2005 to March 2007 sampling period do not affect the results of the HHRA. Methyl acetate was detected in two samples from a single monitoring well (IR07MW20A1) at grid AJ07. Methyl acetate is a volatile chemical that was not detected in the groundwater data set evaluated in the HHRA. However, the planned reuse associated with the location of grid AJ07 is open space (recreational). As discussed in Section A3.5.2, groundwater exposure pathways are incomplete for recreational receptors, and recreational risks from exposure to groundwater were not evaluated for grid AJ07 in the HHRA as a result. Therefore, health risks are not associated with exposure to groundwater at grid AJ07, regardless of analytical results.
SC 13.	---	<p>Response to SC 13: As of the October to December 2006 Parcel B Quarterly Groundwater Monitoring Report and Annual Report, mercury has been detected in two IR-26 wells at concentrations above the HPAL [Hunters Point ambient level]. Since the concentration in IR26MW49A was 0.88 microgram per liter (µg/L), it appears that there is a mercury plume in groundwater at IR-26. Please revise the text of the TMSRA to acknowledge this plume.</p>	<ul style="list-style-type: none"> • The TMSRA has been revised to include a narrative description of a mercury plume in groundwater at wells IR26MW47A and IR26MW49A. Changes were incorporated in Sections 2.1.3.2 (History of Groundwater Actions, Remedial Action Monitoring Program), 2.3.2 (Overview of Groundwater), 3.4.15 (Redevelopment Block BOS-3), and 4.1.2.1 (Groundwater Plumes and Chemicals of Concern); Figure 2-7 (Locations of Current Groundwater Plumes) was also updated. The analysis in the HHRA was not revised because the groundwater data from well IR26MW49A were collected after the end of the evaluation period used for the HHRA, and the concentration of mercury of 0.88 µg/L detected in the sample at well IR26MW49A would not change the conclusions in the HHRA (also refer to the discussion above on SC 4).

TABLE L-1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
SC 36.	---	Response to SC 36: Although the contaminated bottom composite samples were removed when the Fuel-Line excavation was deepened, the approach at that time was based on surface spills, not contaminated fill, so sidewall samples at depths of 3 feet were not collected. Since every bottom composite sample contained copper above the cleanup goal and many contained zinc, it is likely that contaminated fill, possibly spent abrasive blast materials containing copper and zinc, was used in this area. Please revise the text to mention the potential that the Fuel Line F excavation did not remove all of its target contaminants.	<ul style="list-style-type: none"> The Navy believes that placement of spent sandblast grit within the larger body of construction fill is a spill and that the delineation approach used was adequate (also see the response to GC 1, above). The delineation approach described in the final remedial design documents amendment (Tetra Tech 2001), approved by the regulatory agencies, considered the situation that was found at Fuel Line F. The excavation at Fuel Line F was widened and deepened to 6 feet below ground surface (bgs) and was resampled according to the approved plan. The subsequent sidewall and bottom composite samples did not contain copper at concentrations above the cleanup goal. Although results for two of the six bottom composite samples collected at 3 feet bgs exceeded the cleanup goal for zinc, none of the 16 sidewall samples collected at similar depths (ranging from 2 to 4 feet bgs) exceeded the cleanup goal for zinc. The excavation at Fuel Line F was deepened to 6 feet bgs and was resampled according to the approved plan. The subsequent bottom composite samples did not contain zinc at concentrations above the cleanup goal. The Navy disagrees that the characterization for zinc is similar to copper, as implied in the comment. The Navy believes that the excavation at Fuel Line F removed all the target chemicals. The report was not changed as a result of this comment.
SC 41.	---	Response to SC 41: The response addresses the comment, but one of the changes in the second bullet of the response was not implemented. The word <i>other</i> was not inserted into this sentence in the draft final TMSRA as the response indicated.	<ul style="list-style-type: none"> The text of the first paragraph of Section 4.1.1 on page 4-2 was revised as follows: "No ecological RAOs were developed for <i>other</i> soil at Parcel B because most of the land is paved and the parcel contains no identified terrestrial habitat."
SC 47.	---	Response to SC 47: The response does not address the comment. Engineering controls belong in a separate General Response Action (GRA) category and "Remedial Technology Type;" they are not a subset of Institutional Controls. Please revise Tables 4-1 and 4-3 to clarify that Engineering Controls are a separate GRA and Remedial Technology type.	<ul style="list-style-type: none"> Tables 4-1 and 4-3 were revised to list engineering controls as a separate remedial technology type under the general response action of access restrictions. The text of Section 4.3.2.1 was expanded to include a brief discussion of engineering controls.

TABLE L-1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
SC 58.	---	Response to SC 58: The response addresses the comment and was incorporated into the text, but the size of Parcel B is not stated in the TMSRA text (based on a search of the CD), so it is unclear if the revised acreage of the cover types is correct. At the time of the ROD, Parcel B was 63 acres; text in the Executive Summary indicates that IR Sites 6 and 25 were transferred to Parcel C, but the size of this transfer and the total acreage remaining in Parcel B should be presented in the TMSRA. Please revise the TMSRA to state the total acreage in Parcel B.	<ul style="list-style-type: none"> Parcel B currently includes approximately 59 acres. At the time of the record of decision (ROD), Parcel B encompassed 63 acres, which did not include IR-25. The following changes were made in the TMSRA related to this comment: At the end of Section 1.0 on page 1-2: "Parcel B, which includes 59 acres on the north side of HPS, is the focus of this TMSRA." At the end of the first paragraph of Section 2.1.1 on page 2-1: "The adjustment made at the time of the original ROD ... within Parcel C. The adjustment of the parcel boundary to move IR-06 to Parcel C reduced the area of Parcel B from 63 to 59 acres."
SC 70.	---	Response to SC 70: The overall scores of S-2 and S-3 are both "good." However, the text of Section 6.2.8 indicates soil alternative S-3 is more protective than soil alternative S-2 because contaminants are removed. This information is not reflected in Tables ES-1 and 6-2, where both alternatives have equal ratings for all measures, indicating they are equally protective (except for cost).	<ul style="list-style-type: none"> The rating of Alternative S-3 for long-term effectiveness and permanence on Tables ES-1 and 6-2 was changed from "good" to "very good" to indicate this alternative's greater effectiveness over alternatives, such as S-2, that do not involve removal of contaminants. The last sentence of Section 6.1.3.3 on page 6-8 was revised as follows: "The overall rating for Alternative S-3 for long-term effectiveness and permanence is <i>very good</i>." Overall, in comparing Alternatives S-2 and S-3, the better long-term effectiveness of S-3 is tempered by its higher cost; therefore, both Alternatives S-2 and S-3 are rated "good" overall.
Appendix C – Applicable or Relevant and Appropriate Requirements (ARAR)			
SC 7.	---	Response to SC 7: The change indicated in the response was not made to the text.	<ul style="list-style-type: none"> This comment refers to regulations at <i>California Code of Regulations</i> (Cal. Code Regs.) Title (tit.) 27 Section (§) 20921(a)(1) and (2) related to methane. The cited regulations were added to Section C2.1.4—ARARs Conclusions for Air, instead of Section C2.1.3—ARARs Conclusions for Soil, as stated in the response to specific comment 7. The Navy considers the citation of these regulations in the summary of ARARs for air sufficient. The report was not changed as a result of this comment.

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No.	Page	Comment	Response
SC 8.	---	Response to SC 8: The response partially addresses the comment; however, Section C3.1.2 was not updated to include a reference to §1451 through 1464 of the Coastal Zone Management Act as requested in the original comment. Only 1456c is included and there is no explanation why the other portions are not included. Please add this reference or explain why 1456c is the only portion included.	<ul style="list-style-type: none"> • The Coastal Zone Management Act (CZMA) is set forth at 16 <i>United States Code</i> (U.S.C.) § 1451-1464. The Navy reviewed these sections and has determined that Section 1456(c)(1)(A) is the only section that contains substantive requirements that are relevant and appropriate for Navy activities at Parcel B. Because the CZMA specifically excludes federal lands from the coastal zone (16 U.S.C. § 1453[1]) it is not applicable to Navy actions. • The only provision which imposes a substantive obligation on federal agencies is Section 1456(c)(1)(A) which says that each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone shall be carried out in a manner which is consistent, to the maximum extent practicable, with the enforceable policies of approved state management programs. The remaining sections are not substantive and contain Congressional findings and declaration of policy, definitions, grant requirements, hearing requirements, etc. • The Navy also reviewed the CZMA regulations in Title 15 of the <i>Code of Federal Regulations</i> (CFR). 15 CFR Part 923 contains Coastal Zone Management Program regulations. These regulations contain requirements for state coastal zone management program approval and are not ARARs. 15 CFR Part 930 was identified as an ARAR. This part contains requirements for federal consistency with approved coastal management programs; these are the only requirements that are ARARs for the Navy at Parcel B. • The report was not changed as a result of this comment.
SC 14.	---	Response to SC 14: The response addresses the comment; however, the requested change was not made. Please revise the Preliminary ARAR Determination field to identify Section 404 of the Clean Water Act as an applicable ARAR, not an appropriate and relevant ARAR.	<ul style="list-style-type: none"> • The Navy identifies and discusses Clean Water Act § 404 as a potential action-specific ARAR on Table C-5, but not as a potential location-specific ARAR on Table C-3, as was cited in the original comment. The Navy revised the Preliminary ARAR Determination for the Clean Water Act from “relevant and appropriate” to “applicable” on Table C-5 – Federal Action-Specific ARARs. (See page 3 of 6 in Table C-5 under Clean Water Act, as amended [33 U.S.C. Chapter {ch.} 26 §§ 1251-1387].) • The report was not changed as a result of this comment.

TABLE L-1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
SC 17.	---	Response to SC 17: The response indicates the preliminary ARAR determination is <i>Applicable</i> ; however, the preliminary ARAR determination in Table C-5 is <i>Applicable and relevant and appropriate</i> . Please clarify this discrepancy.	<ul style="list-style-type: none"> The preliminary ARAR determination for Cal. Code Regs. tit. 22, § 66264.553(b), (d), (e), and (f) has been revised to applicable <i>or</i> relevant and appropriate. The requirement is applicable for dredged material that meets the definition of a Resource Conservation and Recovery Act (RCRA) hazardous waste or a non-RCRA state-regulated hazardous waste under Cal. Code Regs. tit. 22. The requirement is relevant and appropriate for dredged material that does not meet the definition of a RCRA hazardous waste.
SC 19.	---	Response to SC 19: The response partially addresses the comment; however, the preliminary ARAR determination should reflect the changes made to the comments column of Table C-5. Please change the preliminary ARAR determination in Table C-5 to <i>Applicable OR Relevant and Appropriate</i> . Alternately, the preliminary ARAR determination could be left as relevant and appropriate if a footnote is added indicating there are conditions under which the preliminary ARAR determination may be applicable, and stating those conditions.	<ul style="list-style-type: none"> The preliminary ARAR determination for 40 CFR § 264.554(d)(1)(i) through (ii), (d)(2), (e), (f), (h), (i), (j), and (k) has been revised to <i>applicable or</i> relevant and appropriate.
Additional Comments on Appendix C ARARs (received on July 25, 2007)			
I.	---	Mercury contaminated soil may exceed the RCRA [Resource Conservation and Recovery Act] TCLP [toxicity characteristic leaching procedure] standard and therefore be subject to regulation as a hazardous waste, including Land Disposal Restrictions (LDR). These regulations should be identified as ARARs and the evaluation of the excavation alternative should consider the possibility that the excavated material would be subject to LDRs.	<ul style="list-style-type: none"> The Navy considers LDRs applicable <u>off-site</u> requirements for RCRA hazardous waste and non-RCRA, state-regulated hazardous waste because none of the alternatives evaluated in the TMSRA contemplates on-site disposal. Instead, disposal will occur off site, and compliance with LDRs will rest with the off-site disposal facility. The Navy has considered that the waste it would generate in implementing certain alternatives for soil and groundwater could be RCRA hazardous waste or non-RCRA, state-regulated hazardous waste. In conjunction with these alternatives, the Navy will test the waste to evaluate whether it meets the definition of RCRA hazardous waste or non-RCRA, state-regulated hazardous waste. If the waste meets these definitions, the Navy would comply with all applicable requirements for proper off-site disposal, such as packaging, manifesting, and land disposal restrictions. Table C-1 discusses why LDRs are not ARARs (see page 3 of 4 in Table C-1 under Resource Conservation and Recovery Act) (42 U.S.C., ch. 82 §§ 6901-6991[i]). Therefore, the report was not changed as a result of this comment.

TABLE L-1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2.	---	There is also no discussion of the Off-site Rule in the TMSRA. While the Off-site Rule is not an ARAR, its application to any off-site disposal options should be noted.	<ul style="list-style-type: none"> The text in Section 4.2.3 of the main TMSRA and Section C4.0 of Appendix C was revised to include a discussion of the Off-site Rule as part of the description of the excavation and disposal component of the proposed remediation alternatives. The following text was added at appropriate locations. “Any hazardous substance, pollutant, or contaminant that is shipped off-site as a result of the implementation of this alternative will be shipped to a facility in compliance with 42 U.S.C. § 9621(d)(3) and EPA’s off-site rule at 40 CFR § 300.440.”
Appendix E – Beneficial Use Evaluation for Parcel B Groundwater			
SC 5.	---	<p>Response to SC 5: The response partially addresses the comment; however, there are still a number of areas on Figure E-1 are not shaded/contoured to reflect the total dissolved solids values (TDS). For example, the purple (<3,000 mg/L [milligrams per liter]) contour should extend to additional areas in the vicinity of Building 122 and Building 123, including: well IR61MW05A (2,040 mg/L), well IR10MW12A (1,770 mg/L), well IR10MW32A (952 mg/L), well PA50MW01A (1,440 mg/L), and well IR10MW31A2 (2,230). Additionally the western area of Parcel B contains TDS concentrations that are <3,000 mg/L, but the yellow (3,000 to 10,000 mg/L) and pink (≥10,000 mg/L) shading is inappropriately applied in these areas. Please revise the western portion of Parcel B to show purple (<3000 mg/L) shading, including wells IR07MW24A (1,188 mg/L), IR07MW25A (1,262 mg/L), and remove the yellow shading in this area. Well IR07MW62A [assume this is IR07MW26A] (3,420 mg/L) should fall within the yellow shading rather than pink.</p>	<ul style="list-style-type: none"> Figure E-1 has been revised to address the areas described in the comment.

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No.	Page	Comment	Response
New Comments on the Draft Final TMSRA			
General Comment, APPENDIX J, Metals Concentrations in Franciscan Bedrock Outcrops Study Report			
1.	---	Although Appendix J discusses an investigation of metal concentrations of two Franciscan Complex rock types (specifically, radiolarian chert and serpentinite) at three different locations; it is unclear how this study specifically relates to metal concentrations at HPS. Throughout this appendix, general correlations are made between the results of this investigation and HPS, but no specific comparisons between these three study areas and the soil and rocks of HPS are made. For example, it is unclear whether metals concentrations associated with the Innes Avenue serpentinite outcrop is similar to HPS; it appears that the chromium concentrations may be different, so Innes Avenue may not be representative of the serpentinite used to construct HPS. Please provide a specific comparison between the results of the metals concentrations from the three above mentioned investigation sites with results from HPS.	<ul style="list-style-type: none"> The study provided in Appendix J is designed to provide regional information. The sites identified are not considered a site background according to EPA guidance (EPA 2002a), and therefore a direct data comparison is inappropriate. EPA notes in this guidance that data from regional or local resources may be useful for qualitative analysis of regional conditions (EPA 2002a). The goal of the report in Appendix J is similarly stated in the text: “Knowledge of the normal range of ambient metals concentrations at nonindustrialized sites with a similar geological setting to HPS will provide a better understanding of risks posed by naturally occurring serpentinite, chert, and basalt bedrock.” The report was not changed as a result of this comment.
Specific Comments			
1.	2-18	Section 2.2.4.3, Page 2-18: Please remove the phrase “federal groundwater classification criteria and”.	<ul style="list-style-type: none"> The text of the paragraph that describes the A-aquifer in Section 2.2.4.3 on page 2-18 was revised as follows: “The A-aquifer at Parcel B is also considered unsuitable by the Navy as a potential source of drinking water based on federal groundwater classification criteria and an evaluation of the site-specific factors identified in EPA’s letter...”
2.	---	Table 2-4: Adding a table similar to Table 2-4 that includes the average concentrations for the major risk drivers in the soil removed and also the average concentrations from the lateral confirmation samples would be helpful. The narrative text frequently mentions that the Navy terminated removals because it was essentially chasing ubiquitous metals, but the narrative doesn’t provide any details. Including that information in a table would be a simple way to verify the text and illustrate what was removed and what remains.	<ul style="list-style-type: none"> Detailed information such as average concentrations of chemicals in removed soil and in sidewall confirmation samples is beyond the scope of the TMSRA. Although this information might be helpful, it would require significant additional work that is not within the scope of the final TMSRA nor possible within the current schedule. Data from sidewall confirmation samples is already incorporated into the HHRA; removed samples have no bearing on the HHRA. Even though ubiquitous metals created difficulties during the remedial action, the Navy successfully delineated and excavated chemicals that exceeded cleanup goals at 93 of 106 excavations during the remedial action. Of the remaining 13 excavations, the Navy delineated the extent of chemicals that exceeded cleanup goals at eight excavations although

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			<p>these areas were not completely excavated because the remaining chemicals of concern were considered ubiquitous metals (nearly always manganese). The five remaining excavations were not completely delineated; three of these five were investigating the extent of manganese. Average concentrations of manganese are presented in the Draft Construction Summary Report (Tetra Tech 2002) for excavations with manganese as a chemical of concern. The 13 excavations listed above include:</p> <ul style="list-style-type: none"> – Eight delineated but not excavated: 10-1, 10-2, 10-5, 20-1, 24-9, B0628, B3229, and B3622 – Five not delineated: 7-4, 24-1, 24-8, B3718, and industrial drain line; 3 with manganese: 24-1, 24-8 and B3718 <ul style="list-style-type: none"> • The report was not changed as a result of this comment.
3.	J-3	<p><u>Appendix J, Section 2.2, Franciscan Subunits in the San Francisco Area, Page 3:</u> Item 3 states that there is Marin Headlands Terrane in the southern part of Hunters Point, but Figure 5 depicts the Marin Headlands Terrane in the central part of Hunters Point, specifically on the southern side of Point Avisadero, which is in the center of the shipyard.</p>	<ul style="list-style-type: none"> • Figure 5 shows that the Marin Headlands Terrane underlies all of the southern portion of Hunters Point. Only the portion that outcrops is located in the central part of the shipyard. • The report was not changed as a result of this comment.
4.	---	<p><u>Appendix J, Appendix B, Statistical Results, Tables B-1 through B-13, Summary Statistics Tables:</u> It is unclear why summary statistics have been provided for metals that have as few as one or two detects, when the sample sizes range from 15 to 100. Although summary statistics can be calculated for a single detect from a sample size of 100, the resulting statistics reflect a summary of the detection limit and not a summary of likely population (actual) concentrations. Please delete summary statistics for metals with fewer than 3 detects.</p>	<ul style="list-style-type: none"> • The summary statistics are used to generate box plots (Attachment B1). The box plots indicate whether the data is based on non-detect (censored) data (hollow circles) or detected data (filled circles). Completing statistics for all metals regardless of detections allows for a complete set of plots. The plots clarify which metals are frequently or infrequently detected, as well as the range of detections. Section 3 of Attachment B describes the statistical approach for data sets with more than 15 percent censored data. "For samples with greater than 15 percent censored data, population moments (such as the mean and standard deviation) were calculated using stochastic modeling, following the "bounding" approach described in EPA (2002b). This approach treats each censored datum as a random variable that can assume any value between zero and its respective reporting limit." The statistical basis is appropriate and clearly defined. The box plots clearly identify the data distribution of both detects and non-detects. • The report was not changed as a result of this comment.

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5.	J-13	<u>Section 5.2 Risk Evaluation, Subsection 5.2.2 Twin Peaks Boulevard, Page 13:</u> The text indicates that the hazard index (HI) is primarily attributed to manganese and nickel. However, after computing a handful of the hazard quotient ratios for the Twin Peaks dataset, it appears that the HI is predominantly attributed to manganese and iron and, to a lesser extent, antimony, arsenic, barium and copper. Please recalculate the HI for the Twin Peaks dataset to ensure that the text adequately reflects the quantitative results.	<ul style="list-style-type: none"> The data set was reviewed. The text of Section 5.2.2 was revised as follows to identify manganese and iron as the primary contributors to the HI. "The HI ranged from 9.8 to 63 for samples collected at the Twin Peaks Boulevard site, and is primarily attributed to manganese and nickel iron (Figure C-4)."
Minor Comments			
1.	J-13	<u>Appendix J, Section 5.2 Risk Evaluation, Subsection 5.2.1 Innes Avenue, Page 13:</u> The first paragraph under Subsection 5.2.1 indicates that the excess lifetime cancer risk (ELCR) for samples collected at the Innes Avenue ranged from 1.2E-06 to 1.6E-05. However, the final sentence of the aforesaid paragraph discusses that the ELCR from the remaining samples was between 1E-05 and 1E-04. It is unclear if the aforementioned ELCR range is a typographical error and should be changed to 1E-06 and 1E-05. Please review the text in Section 5.2.1 to substantiate that the text corresponds to the quantitative results.	<ul style="list-style-type: none"> This typographical error was corrected. The last sentence of Section 5.2.1 was revised as follows: "The ELCR from 24 of the 33 samples (about 75 percent) was below 1×10^{-5}; the ELCR from the remaining samples was between 1×10^{-5} and 1×10^{-6}." The text of Section 5.2.1 now accurately reflects the quantitative results.
2.	J-14	<u>Appendix J, Section 5.2 Risk Evaluation, Subsection 5.2.3 Malta and O'Shaughnessy, Page 14:</u> The first sentence on page 14 is incomplete. Please complete the first sentence on the top of page 14 to include the primary attribution of the HI.	<ul style="list-style-type: none"> This typographical error was corrected. The last sentence of Section 5.2.3 was revised as follows: "The HI for samples ranged from 4.7 to 36 collected at the Malta and O'Shaughnessy site, and is primarily attributed to manganese and iron (Figure C-6)."

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The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the “Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated June 22, 2007. Comments were submitted by Thomas P. Lanphar (DTSC) on July 23, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the draft final TMSRA, even though some of these numbers have changed in the final TMSRA.

No.	Page	Comment	Response
General Comments			
1.	---	Ubiquitous Metals. DTSC supports soil remedies that address total risk, including risk from ambient or ubiquitous metals (S-4 and S-5). DTSC does not agree that ambient metals are naturally occurring and therefore DTSC does not agree with the Navy’s definition of ubiquitous. As stated in our comments on the draft Parcel B TMSRA, DTSC can accept ‘agree to disagree’ language on this issue.	<ul style="list-style-type: none"> The following text was added to the TMSRA to explain the difference of opinion between the Navy and DTSC on this issue: <i>“The Navy acknowledges that DTSC does not agree with the Navy’s position that ubiquitous metals are naturally occurring. Remedial alternatives developed in this TMSRA address these concentrations of metals, regardless of their source.”</i> These new sentences were added to the TMSRA after the description of the term “ubiquitous” in the Executive Summary (page ES-5), Section 1.2.1 (page 1-4), and Section 2.3 (page 2-19).
2.	---	Groundwater. DTSC supports the continued monitoring of Volatile Organic Compounds (VOCs) and increased monitoring of mercury in groundwater at IR-26. DTSC is unable to concur on the appropriateness of the elimination of groundwater monitoring wells and of other metals as contaminants of concern in groundwater. In our comments on the draft TMSRA, DTSC requested the continued monitoring of metals along the shoreline. DTSC will provide more specific comments on the TMSRA groundwater monitoring proposal after our review of the upcoming Appendix I “Trigger Levels for Groundwater Impact to San Francisco Bay.”	<ul style="list-style-type: none"> Quarterly groundwater monitoring at Parcel B since 1999 has not indicated new, previously undiscovered sources of groundwater contamination at Parcel B. Contaminants that may remain in place have not affected groundwater to date and are not expected to affect groundwater in the future. Please also refer to the responses to comments on Appendix I in Attachment II.

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No.	Page	Comment	Response
2. (cont.)	---	<p>The Navy is proposing a dynamic groundwater monitoring program, one that can adapt to new information and concerns. DTSC conceptually agrees with this approach; however, the process for reviewing groundwater information and making changes is still in development. The groundwater monitoring alternative described in Section 5 appear more prescriptive by defining monitoring of the mercury at IR-26 and VOCs at IR-10. Please include in the groundwater monitoring alternatives a description of the dynamic monitoring program proposed by the Navy. The current monitoring program at Parcel B, the Remedial Action Monitoring Program, is part of the current remedy and changes to this remedy must be approved by the regulatory agencies. A future and dynamic Remedial Action Monitoring Program will also be part of the Parcel B remedial action and the process for modifications and approval must be defined in the Parcel B ROD Amendment.</p>	<ul style="list-style-type: none"> • The Navy is pleased that DTSC agrees with the conceptual approach outlined for groundwater monitoring. The groundwater monitoring plan developed in the remedial design will include strategies from EPA's Triad approach. Dynamic work strategies (one of the three central Triad concepts) incorporate the flexibility to change or adapt to new information. The Base Realignment and Closure Cleanup Team (BCT) will use information as it is gathered to best tailor future groundwater monitoring. The Navy envisions an adaptable program, where wells and analytes will be easily added or removed as necessary. The Navy will work closely with the BCT during development of the groundwater monitoring plan. • As noted in the comment, the approach is still under development for application to the current basewide groundwater monitoring program. Details of the adaptable strategy will be contained in the future remedial action monitoring program that will be part of the remedial design. The change management process for modifications to the monitoring program will be part of the design document, which will, itself, be subject to the approval of the Federal Facility Agreement (FFA) signatories. • The report was not changed as a result of this comment.
3.	---	<p>Methane. In 2005 the Navy detected methane in one area during a comprehensive survey of Installation Restoration (IR) Sites 07 and 18. DTSC agrees with the Navy's proposal to remove the methane source. The Navy states that the cleanup standards for methane at landfill sites, although not applicable, are relevant and appropriate to the methane source area at IR-07 and the Navy accepts the substantive provisions of the regulations at Title 27 of the California Code of Regulations, Section 20921(a)(1) and (2). These California Regulations are within Article 6, Gas Monitoring and Control at Active and Closed Disposal Sites. The use of these standards applies to landfills with existing methane generating sources.</p>	<ul style="list-style-type: none"> • The purpose of the methane source removal is to eliminate sources of methane gas that would result in an accumulation of methane gas in an on-site structure at a concentration above 1.25 percent by volume in air, or that would result in methane gas at the facility boundary at a concentration above 5 percent by volume in air, as required in Cal. Code Regs. tit. 27, § 20921(a)(1) and (a)(2) cited as potential chemical-specific ARARs. The Navy fully expects, based on the circumstances surrounding the detection of methane, that excavating soil to (or below) 1.25 percent by volume in air will result in compliance with the ARAR and will be protective of human health and the environment. The Navy will confirm the success of the remediation by collecting soil gas samples after the excavation is complete.

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No.	Page	Comment	Response
3. (cont.)	---	<p>They are not intended as a standard for determining the successful removal of a methane source or a determination that no further action is necessary. Further, the State of California uses the standards found in Title 27 of the California Code of Regulations, Section 20921(a)(1) and (2) in conjunction with other regulating provisions; including the entire Title 27, Chapter 3, Subchapter 4, Article 6 and Subchapter 5, Article 2, Section 21190 – Post Closure Land Uses.</p> <p>In 2005, DTSC published the “Advisory on Methane Assessment and Common Remedies at School Sites” (Advisory). The purpose of the Advisory is to provide guidance on investigations and common remedies for school sites; however, the recommendations are considered protective of public health and are based upon a survey of local regulations and ordinances that address a myriad of source of methane and land uses. As stated in the DTSC Advisory:</p> <p>“Methane is an asphyxiant and is combustible and potentially explosive when it is present at concentrations in excess of 53,000 parts per million by volume (ppmv) in the presence of oxygen. This concentration is referred to as the Lower Explosive Limit (LEL). In order to provide some margin of safety, a concentration of approximately ten percent (10 percent) of the LEL, or 5,000 ppmv is commonly utilized as an “action level” above with mitigative measures are recommended.</p>	<ul style="list-style-type: none"> • The Navy will not accept any other provisions in Cal. Code Regs. tit. 27, Chapter 3, Subchapter 4, Article 6 or Subchapter 5, Article 2 § 21190, as potential state action-specific ARARs because the Navy will not identify for the transferee post-transfer land uses or design requirements. Instead, the Navy would use the IC component that requires engineering controls unless it is demonstrated that these engineering controls are not necessary to address levels of methane gas that present an explosive hazard. The regulatory agencies will have the opportunity to review, comment on, and concur in the design and application of the engineering controls or the demonstration that no engineering controls are necessary. • The Navy plans to remove the source of methane as part of a time-critical removal action that is scheduled to be implemented before the ROD amendment is completed. The Navy will use visual observations of waste that may be the source of methane during the removal to guide the cleanup and will conduct a soil gas survey following the removal to identify whether methane is still present and may pose an unacceptable risk. The Navy will continue to discuss the remediation strategy for methane with the regulatory agencies during preparation of the proposed plan and ROD amendment.

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No.	Page	Comment	Response
3. (cont.)	---	<p>Where it is present at concentrations in excess of 5,000 ppmv, it is often conservatively presumed that methane may infiltrate through flooring material or cracks, accumulate under footings and in enclosed spaces (e.g., small rooms, vaults, wall spaces), and then cause a fire or explosion when an ignition source (e.g. pilot flame, electrical spark, cigarette) is present.”</p> <p>DTSC’s methane Advisory defines a methane hazard as an accumulation, or potential accumulation of methane in the subsurface at concentrations in excess of 5,000 ppmv. According to the Advisory, further response action (e.g. periodic monitoring, removal action) may be needed for sites with methane detection at or above 5,000 ppmv, or methane pressure of 0.5 pounds per square inch (psi), 13.0 inches of water, or 1 inch of mercury. Because the purpose of the Hunters Point cleanup standard for methane is to determine if further action in regards to methane is required, DTSC requests that 5,000 ppmv (5 percent by volume in air) is adopted.</p> <p>DTSC understands that the proposed land use for 1R-07 and 18 is open space; however, this designation does not restrict above or below ground structures in this area. Methane in soil at the 1.25 percent (by volume in air) cleanup standard proposed by the Navy, indicates a continued methane source and methane hazard. Therefore, in order to protect public health at this site, if 1.25 percent is selected as the cleanup standard, the State of California requests that the substantive requirements of Title 27, Chapter 3, Subchapter 4, Article 6, and Subchapter 5, Article 2, Section 21190 – Post Closure Land Use be identified as an ARAR.</p>	(see above)

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4.	---	<p>Seawalls. DTSC's objective in requesting that the seawalls are included in the soil remedy is to ensure the integrity of the soil cap/cover at the shoreline to protect public health and the environment. Remedial Actions under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) can not rely on requirements not identified as ARARs or Institutional Controls. DTSC requested that continued maintenance of the seawall be included as an Institutional Control in order to ensure the integrity of the soil cap/cover at the shoreline. DTSC is willing to explore other language that ensures the lateral containment of soil at the 'leading edge' of the protective cap; however, this language must ensure the caps integrity at the shoreline.</p>	<ul style="list-style-type: none"> • Institutional controls will be in place to protect the integrity of covers, including the edges of the covers, and to require periodic inspection and maintenance. The Navy is committed to preserving the integrity of the soil cover remedy. However, the Navy views maintenance of the seawalls as a separate and unrelated issue. The Navy does not propose to include long-term maintenance of the seawalls as part of the remedy in the upcoming ROD amendment. The integrity of soil covers, including the edges, can be adequately maintained without requiring on-going maintenance of the seawalls. Please also refer to the discussion on seawalls in the Navy's position letter sent to the BCT on May 18, 2007 (included as Attachment L1). • The report was not changed as a result of this comment.
5.	---	<p>Remedial Action Objectives for VOCs in soil. In our comments on the draft Parcel B TMSRA, DTSC requested soil Remedial Action Objectives for the protection of human health from inhalation of soil gas containing VOCs. VOCs in soil gas are known to occur at Hunters Point Shipyard. The Parcel B TMSRA includes Soil Vapor Extraction (SVE) as a remedial alternative for soil. DTSC agrees with the Navy's proposal to address potential issues related to vapor intrusion by collecting site-specific soil gas sampling after remediation is complete to demonstrate that the remedy is operating properly and successfully. DTSC understands that because of varying and changing site conditions, the risk from soil gas can not be determined until after the soil gas survey is completed. Still, DTSC requests that a Remedial Action Objective for soil gas be proposed that is protective of residential, commercial, and industrial workers from outdoor and indoor inhalation of VOCs in soil gas.</p>	<ul style="list-style-type: none"> • The text of Section 4.1 was revised to add the following remedial action objective (RAO) for soil gas: • Prevent exposure to VOCs in soil gas at concentrations that would cause unacceptable risk via indoor inhalation of vapors. Remediation goals for soil gas will be established during the remedial design.

TABLE L-3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC), Human and Ecological Risk Division (HERD) on the “Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated June 22, 2007. Comments were submitted by James Polisini (HERD) on August 28, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the draft final TMSRA, even though some of these numbers have changed in the final TMSRA.

No.	Page	Comment	Response
General Comment			
1.	---	The Response to Comments (RTC) submitted by HERD, included as part of Appendix K Table 3, was reviewed and responses are generally acceptable. HERD would generally recommend that: 1) any HHRA contain a presentation of summed risk and/or hazard from exposure to both soil and groundwater; and, 2) that the ERA describe the location and concentration of sediment samples with potential contaminants between the National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) and Effects Range-Median (ER-M). However, given that: 1) the focus of this document is presentation of remedial alternatives which are media-restricted; and, 2) intertidal remedial alternatives for ecological hazard will address the entire Parcel B shoreline (i.e., areas exceeding both the ER-L and ER-M laterally), HERD accepts the HHRA and ERA methodology as applied to the Parcel B TMSRA.	<ul style="list-style-type: none"> • Comment acknowledged; no response required.
Specific Comments – Volume 1			
1.	---	The HHRA in the TMSRA addresses risk and/or hazard associated with chemicals that are not radioactive. A radiological addendum to the TMSRA is being prepared to evaluate remedial alternatives for radiological contamination (Section 6.5.4, page 6-34). This TMSRA addendum will then address cumulative risk from both chemical and radiological contaminants (Executive Summary, page ES-6; Section 1.2.4, page 1-8). Evaluation of Parcel B remedial alternatives should not be completed until the cumulative chemical and radiological risk and/or hazard estimates are available.	<ul style="list-style-type: none"> • The radiological addendum to the TMSRA includes a summary of risks from chemical and radiological contaminants. The draft radiological addendum was submitted on July 3, 2007; the final radiological addendum is scheduled to be submitted in late November 2007. • The report was not changed as a result of this comment.

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No.	Page	Comment	Response
2.	---	Approximately 75 percent of Parcel B is currently covered by pavement and buildings with little open space or terrestrial habitat (Section 3.2, page 3-9). The SLERA correctly addresses the currently available intertidal habitat and aquatic exposure to Parcel B groundwater in evaluating Parcel B ecological hazard. Changes in future use which results in establishment of more significant terrestrial habitat will require re-evaluation of the potential ecological hazard associated with terrestrial contaminants.	<ul style="list-style-type: none"> The current redevelopment plan does not include establishment of any ecological habitat. Institutional controls will be in place to control future changes in land use. The FFA signatories will have approval over those future changes and will be able to consider potential ecological hazards when changes to land uses are proposed. The report was not changed as a result of this comment.
Specific Comments on Human Health Risk Assessment – Appendix A			
3.	---	The methodological revisions to the HHRA for the Parcel B TMSRA (Section A.2.0, page A-3, seven bulleted items) address many HERD comments on previous HHRA reports. This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractor.	<ul style="list-style-type: none"> Comment acknowledged; no response required.
4.	---	For groundwater, non-detected (U-qualified) and estimated below reporting limit samples (UJ-qualified) were excluded from the data set to reduce the influence of historical sample results reported as non-detected (Section A.4.1, page A-9). HERD does not object to this data reduction process as long as sufficient reported data remain to provide a sufficiently accurate estimate of groundwater concentrations. Please provide a table, or reference the existing table, which indicates either the percent of samples reported as detect or the percent of samples reported as U-qualified and UJ-qualified.	<ul style="list-style-type: none"> Tables A3-1 through A3-7 of the TMSRA summarize the groundwater data evaluated in the HHRA for Parcel B. The data presented in these tables are organized by each groundwater exposure area and aquifer evaluated in the HHRA. These tables include information on chemical detection frequencies (based on the data set for the HHRA) and the range of detection limits for nondetected results (that is, U- and UJ-qualified data). Please note that, based on regulatory agency comments, the Navy agreed to use the results of the maximum concentration scenario to identify chemicals of concern for groundwater. (See Sections A5.1.2 and A9.6 of Appendix A of the TMSRA.) This approach provides an additional measure of conservatism to the risk evaluation and addresses the potential underestimate of risks associated with limiting calculation of exposure point concentrations (EPC) for groundwater to detected results. The report was not changed as a result of this comment.

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5.	---	Risk and or hazard for each potential receptor scenario is evaluated for each redevelopment block regardless of the planned use (Section A4.3.1, page A-11). This provides the residential use scenario estimates of risk and/or hazard for consideration during evaluation of remedial alternatives. This comment is meant for the DTSC Project Manager and not response is required from the Navy or Navy contractor.	<ul style="list-style-type: none"> • Comment acknowledged; no response required.
6.	---	HERD defers to the DTSC Geological Services Unit (GSU) for evaluation of the plume delineation for Volatile Organic Compounds (VOCs) and hexavalent chromium (Section A4.3.2, page A-13; Attachment A4).	<ul style="list-style-type: none"> • Comment acknowledged; no response required.
7.	---	The U.S. EPA statistical program for calculating the Exposure Point Concentration (EPC) has been updated from the ProUCL 3.0 used to estimate the groundwater EPC (Section A5.1.2, page A-18) to ProUCL 4 (http://www.epa.gov/esd/tsc/software.htm). EPCs need not be recalculated for the Parcel B TMSRA, but future HHRA documents should utilize this updated version.	<ul style="list-style-type: none"> • Comment acknowledged. The Navy will use ProUCL 4 to calculate EPCs for groundwater in future HHRA's that incorporate new data, such as the HHRA for Parcel E-2. As noted in the comment, recalculation of EPCs for groundwater is not required for Parcel B. • The report was not changed as a result of this comment.
8.	---	HERD reviewed the following components of the HHRA and has no recommendations on the methodology used. Rather than providing specific comments for each, the HHRA components for which HERD has no recommendations or additional requirements are: <ol style="list-style-type: none"> Exposure Point Concentrations (EPCs) for Soil (Section A5.1.1, page A-17); EPC for Groundwater (Section A5.1.2, page A-18); EPCs for media other than soil and groundwater (Section A5.1.3, page A-21; Tables A-2 through A-3); Exposure Parameters and Dose Estimates (Section A5.2, page A-24; Tables A-4 through A-9); Exposure to Lead (Section A6.4, page A-27); 	<ul style="list-style-type: none"> • Comment acknowledged; no response required.

TABLE L-3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
8. (cont.)	---	<p>f. Toxicity Assessment (Section A6.0, page A-25; Table A-11 and A-12); and,</p> <p>g. Lead Evaluation (Section A6.4, page A-2; Section A7.4, page A-33).</p> <p>This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractors.</p>	<ul style="list-style-type: none"> Comment acknowledged; no response required.
9.	---	<p>A 'buffer zone' of 100 feet is applied to VOC plumes and to non-plume groundwater wells with VOCs as Contaminants of Potential Concern (COPCs) (Section A9.3, page A-44) based on reference to EPA guidance (EPA, 2002). A representation of the subsurface utilities which may act as preferential migration pathways (Figure A-9) in excess of the 100 foot inhalation risk 'buffer zone' (Figure A-8) (Section A9.3, page A-44). This figure should be consulted during evaluation of remedial alternatives where risk and/or hazard associated with VOCs is potentially involved. This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractor.</p>	<ul style="list-style-type: none"> Comment acknowledged; no response required.
Specific Comments on Ecological Risk Assessment – Appendix B			
10.	---	<p>The Screening Level Ecological Risk Assessment (SLERA) provided in the Parcel B TMSRA address potential ecological hazard associated with Parcel B groundwater movement into San Francisco Bay and direct exposure of benthic invertebrates to Parcel B intertidal and subtidal sediments (Section B1.1, page B-2). This descriptive comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractor.</p>	<ul style="list-style-type: none"> Comment acknowledged; no response required.

TABLE L-3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
11.	---	<p>HERD reviewed the following components of the SLERA and has no recommendations on the methodology used. Rather than providing specific comments for each, the SLERA components for which HERD has no recommendations or additional requirements are:</p> <ul style="list-style-type: none"> a. Conceptual Site Model (Section B2.1, page B-3); b. Fate and Transport Pathways (Section B2.1.2, page B-4); c. Exposure Pathways (Section B2.1.3, page B-4); d. Assessment and Measurement Endpoints (Section B2.1.4, page B-5); e. General Approach (Section B2.2, page B-7); f. Toxicity Reference Values (TRVs) for Birds and Mammals (Section B2.3.3, page B-11); g. Vertebrate Exposure Parameters (Section B4.1.3, page B-17 through B-27); <p>This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractors.</p>	<ul style="list-style-type: none"> • Comment acknowledged; no response required.
12.	---	<p>Ecological Hazard to benthic invertebrates is evaluated by comparison to only the NOAA ER-M, (Section B2.3.1, page B-10) which is the midpoint of the sediment concentrations evaluated by NOAA in setting sediment screening criteria. HERD typically requires the evaluation of benthic invertebrate receptors by comparison to both the NOAA ER-Ls, the 10th percentile of the NOAA sediment data set, and ER-Ms. Given that the intertidal sediment remedial alternatives for ecological hazard including a revetment will address the entire Parcel B shoreline (Volume I, Section 4.3.2.1, page 4-24; Section 5.1.1, page 5-2; Appendix K, Response to EPA Comment number 10 on Draft TMSRA, Table 1, page 10), HERD accepts the ER-M comparison for this Parcel B TMSRA.</p>	<ul style="list-style-type: none"> • Comment acknowledged; no response required.

TABLE L-3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
13.	---	There is, in fact, no 'standard convention' of lowering an acute aquatic toxicity by 80 percent (Section B2.3.2, page B-11) to estimate a chronic toxicity value where no chronic toxicity value exists. Given that the majority of the mobile groundwater contaminants lacking chronic toxicity values are inorganic elements of lower acute toxicity, HERD does not require revision of the subset of 'estimated' chronic toxicity values which used this method. The 'standard convention' phrase, based on a 20 year old EPA document (Gold Book) should be removed from the text.	<ul style="list-style-type: none"> The text of Section B2.3.2 in the first full paragraph on page B-11 was revised as follows: "If no first-tier criterion was available for a specific analyte, an acute value was selected as a second-tier criterion. Each acute criterion was made more protective, and thus conservative, by applying the standard convention of lowering the value by 80 percent to make acute criteria more appropriate for use in chronic exposure scenarios (EPA 1986). Where no first- or second-tier criteria were available, instantaneous criteria were used as third-tier criteria. Each instantaneous criterion was made more protective by applying the standard convention of lowering the value by 90 percent to make instantaneous criteria more appropriate for use in chronic exposure scenarios (EPA 1986). In those cases where no first-, second-, or third-tier criteria were available, published EPA lowest-observable-effects criteria were included for screening. The selected screening criteria for the evaluation of Parcel B groundwater are shown in Table B-5 along with the basis for the selection."
14.	---	The SLERA identifies Contaminants of Potential Ecological Concern (COPECs) for surface sediment (Section B3.1, page B-13), subsurface sediment (Section B3.2, page B-13) and groundwater (Section B3.3, page B-14) which pose potential ecological hazard for benthic invertebrates. After comparison to regional 'ambient' concentrations, 'refined' lists of COPECs for surface sediment (Section B5.1.2.1, page B-34), subsurface sediment (Section B5.1.2.2, page B-35) and groundwater (Section B5.1.2.3, page B-36) are presented. This descriptive comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractor.	<ul style="list-style-type: none"> Comment acknowledged; no response required.

TABLE L-3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
15.	---	<p>The SLERA identifies COPECs for surface and subsurface sediments which pose potential ecological hazard to birds (Section B4.4.1, page B-29) and mammals (Section B4.4.2, page B-30). No red-tailed hawk SLERA Hazard Quotients (HQs) exceeded one indicating no significant potential adverse effects for this receptor. Estimates of ecological hazard to birds using: 1) the 95 percent upper confidence limits on the mean rather than the maximum concentration as the EPC; and, 2) site specific exposure scenarios, identified COPECs which pose potential adverse ecological hazard (Section B5.1.3.1, page B-39; Tables B-26 and B-27). Estimates of ecological hazard to mammals using 1) the 95 percent upper confidence limit on the mean rather than the maximum concentration as the EPC and 2) site specific exposure scenarios identified COPECs which pose potential adverse ecological hazard (Section B5.1.3.2, page B-46; Tables B-26 and B-27). This descriptive comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractor.</p>	<ul style="list-style-type: none"> • Comment acknowledged; no response required.
16.	---	<p>The HQs for ten groundwater COPECs (arsenic, copper, lead, mercury, selenium, zinc, alpha-chlordane, endrin aldehyde, gamma-chlordane and heptachlor) exceeded 1.0 (Section B5.1.2.3, page B-36). All these COPCs except mercury are not retained as COPECs based on trends, subsequent sample results and comparison of the 16 point of compliance samples over 12 sampling periods to groundwater 'ambient' concentrations. HERD does not agree that all of these groundwater COPECs should be dropped. For example, groundwater detections of lead appear to be increasing in concentration over time (Figure B1-3a). In addition, comparison to the 16 point-of-compliance-wells provides evaluation of the ecological hazard only over the 12 sampling periods included.</p>	<ul style="list-style-type: none"> • The Navy disagrees with the conclusion that concentrations of lead in the subset of wells evaluated for the SLERA are increasing. Only five groundwater samples contained lead at a concentration that exceeded the Hunters Point groundwater ambient level (14.4 µg/L). Subsequent samples collected from all wells resulted in lower concentrations (so that refined hazard quotients were less than 1). Lead was not retained as a COPEC for aquatic receptors because detected concentrations that resulted in refined HQs above 1 were infrequent and sporadic. • The evaluations presented in Appendix I of the draft final TMSRA include an assessment of results for groundwater samples collected from wells that are inland of the 16 wells used in the SLERA.

TABLE L-3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
16. (cont.)	---	A relatively simple evaluation of groundwater well samples further inland from the point of compliance wells for the full list of ten COPECs would provide an assessment of future ecological hazard as groundwater moves toward San Francisco Bay. However, control of groundwater mercury concentrations (Volume 1, Section 6.5.5, page 6-35) will most likely also control other groundwater COPECs (e.g., lead).	<ul style="list-style-type: none"> The Navy agrees that the proposed source removal for mercury may also reduce concentrations of other metals, such as lead, in groundwater in the same area. The report was not changed as a result of this comment.
17.	---	Sediment remedial actions to address the potentially significant ecological hazard for birds, indicated by HQs greater than 1.0 based on the high Toxicity Reference Value (TRV _{high}) (Section B5.1.3.1, page B-39), will most likely address the lesser potential ecological hazard for mammals, indicated by HQs greater than 1.0 bases on the low Toxicity Reference Value (TRV _{low}) (Section B5.1.3.2, page B-46). This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy contractor.	<ul style="list-style-type: none"> Comment acknowledged; no response required.
Conclusions			
1.	---	<p>(a) Evaluation of remedial alternatives for the protection of human health should not be completed until the pending addendum to the HHRA which will address summed risk and/or hazard associated with chemical and radiological exposures.</p> <p>(b) The 100 foot buffer zone applied to groundwater plumes and groundwater wells with detected VOC results should be protective of human health as long as the presentation of underground utilities which may serve as preferential migration pathways is considered when evaluating future land use and remedial alternatives.</p> <p>(c) Given that potential ecological hazard is associated with the intertidal sediment and the remedial alternatives to address ecological hazard include a revetment which will address the entire Parcel B shoreline, HERD accepts the ER-M sediment comparison for this Parcel B TMSRA because consideration of the ER-L would not increase the remediation area.</p>	<ul style="list-style-type: none"> (a) See the response to specific comment 1. (b) Comment acknowledged; no response required. (c) Comment acknowledged; no response required.

TABLE L-3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
1. (cont).	---	(d) While other groundwater COPECs, in addition to mercury, appear to pose potential adverse ecological hazard, control of groundwater mercury concentrations would most likely also control other groundwater COPECs (e.g., lead).	<ul style="list-style-type: none"> (d) Comment acknowledged; no response required.

TABLE L-4: DRAFT RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the San Francisco Bay Regional Water Quality Control Board (Water Board) on the "Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California," dated June 22, 2007. Comments were submitted by James Ponton (Water Board) on July 23, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the draft final TMSRA, even though some of these numbers have changed in the final TMSRA.

No.	Page	Comment	Response
General Comments			
1.	---	<u>General RTC No. 1, Installation Restoration Site (IR) Site 26</u> We are pleased with the Navy's proposal to modify Alternatives S-3, S-4, and S-5 to include mercury source removal in the EE-05 excavation area.	<ul style="list-style-type: none"> • Comment acknowledged; no response required.
2.	---	<u>General RTC No. 2, Groundwater Evaluation Criteria</u> The Navy's response to our March 2006 (Water Board 2006) letter is not included in this version of the TMSRA. The TMSRA states that the issues raised in our letter will be addressed in the missing Appendix I that is scheduled for an August 7 release. With the understanding that the trigger level discussion developed in the Parcel D FS (SulTech 2007) will closely resemble Appendix I, I have used the key elements of the Parcel D FS (i.e., Appendix G, Groundwater Modeling and Calculation of Attenuation Factors, Appendix H, Preliminary Screening of Groundwater Impacts to San Francisco Bay, and Appendix I, Trigger levels for Groundwater Impacts to San Francisco Bay) as surrogates for this discussion. Although this decision was made to meet our TMSRA review schedule commitment, before this report can be finalized we need to review Appendix I.	<ul style="list-style-type: none"> • The Navy does not plan to issue a separate response to the Water Board's letter from March 2006. The information in response to the letter is contained in the TMSRA. • Please also refer to the responses to comments on Appendix I in Attachment II. • The report was not changed as a result of this comment.
2a.	---	<u>Point of Compliance</u> We disagree on the definition of point of compliance (i.e., where we measure groundwater discharge to the bay) We request the point of compliance (POC) apply to a monitoring well or sampling point, located on what is essentially "lands end." You define the point of compliance as: <ul style="list-style-type: none"> • The interface of A-aquifer groundwater with the bay (Appendix C, page C-26) • Areas within the shoreline sediment pore space and areas where groundwater surfaces and mixes with surface water of the bay (Appendix K, Table 4, page 124), and 	<ul style="list-style-type: none"> • The Navy does not agree with the use of the term "point of compliance" to refer to the general discharge of groundwater into surface water. "Point of compliance" has specific regulatory-driven definitions that are not applicable or relevant and appropriate to the discharge of groundwater from Parcel B into the bay. The Navy defines the point of exposure (POE) for groundwater discharge to surface water as the interface of the sediment and the surface water. Groundwater is present below that interface; surface water is present above it. Surface water quality criteria do not apply to groundwater below the interface.

TABLE L-4: DRAFT RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2a. (cont.)	---	<ul style="list-style-type: none"> The surface water at the interface of A-aquifer groundwater with the bay (Appendix C, Section C2.2.2, page C-26). <p>Your proposal to sample bay water will provide no information on the quality of groundwater entering the bay due to gross surface water mixing and resultant dilution effects nor does it provide those data necessary in evaluating the need for a groundwater corrective action targeted at protecting the bay.</p>	<ul style="list-style-type: none"> The Navy does not propose to sample surface water in the bay, but instead to establish a point of measurement (POM) at a groundwater monitoring well near the shoreline. The analytical results of the groundwater sample obtained at the POM can be compared against the trigger levels estimated for that specific location to identify whether additional evaluations are necessary. The additional evaluations that may occur if a trigger level is exceeded include: <ul style="list-style-type: none"> Increasing the frequency of monitoring in the well where the trigger level was exceeded to evaluate whether the elevated level is persistent; Monitoring groundwater at a location farther downgradient to evaluate whether the attenuation estimated in establishing the trigger level has occurred; Using site-specific, detailed information to more accurately estimate attenuation (including processes such as adsorption, as has been proposed at Alameda Point [formerly Naval Air Station Alameda] Site IR-28) and degradation; or Implementing a selected remediation alternative for groundwater treatment. Evaluations will occur during the Parcel B remedial design. The text of Section 15.0 was revised to include the following discussion of POE and POM. <i>“Trigger levels apply only to specific locations and chemicals; the point of measurement for comparison to a trigger level will be an individual groundwater monitoring well. In some cases, the point of measurement may be a well near the shoreline. For COCs that exist in groundwater near the shoreline, the chemical concentrations in groundwater at the point of measurement will be used to represent the concentrations that exist farther bayward at the interface of the sediment and the surface water of the bay where groundwater discharges (the point of exposure).”</i>

TABLE L-4: DRAFT RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2a. (cont.)	---	<p>The Navy's proposed A-aquifer to surface water POC also appears to conflict with the stated purpose of groundwater monitoring program which is to:</p> <ul style="list-style-type: none"> • Demonstrate that concentrations of the surface water quality contaminants of concern (COCs) in the groundwater are less than their respective trigger levels; or that the plumes that contain these COCs are stable (i.e., the plume is not migrating to the surface at concentrations that will exceed the surface water remedial goals); and, • Provide information (data) used in evaluating the potential need for corrective action to protect surface water. <p>We maintain that measuring the bay water does not satisfy the stated goals of your groundwater program.</p>	<ul style="list-style-type: none"> • The planned sampling at the POM and comparison to trigger levels is consistent with the Navy's goals for the groundwater monitoring program. The Navy does not plan to sample water from the bay.
		<p>Lastly, the TMSRA should propose monitoring methods and techniques to satisfy the intent of the groundwater program in the near shore setting. Similar groundwater to surface water issues are being researched and worked on by Water Board Region 9 and Navy at North Island, San Diego. The following web links reference groundwater monitoring techniques and strategies for the near shore environment being used at North Island and which may be applicable to a Hunters Point setting. These links include:</p> <p>http://www.spawar.navy.mil/sti/publications/pubs/td/2790/index.html http://www.clu-in.org/products/newsletters/trend/view.cfm?issue=tt1100.htm http://www.spawar.navy.mil/sti/publications/pubs/tr/1799/tr1799.pdf http://www.cpeo.org/techtree/ttdescript/petrex.htm http://www.nelp.navy.mil/pdf_cases%5CCleanup_Site9_Offshore_Sampling.pdf</p>	<ul style="list-style-type: none"> • Sampling procedures will be specified in the groundwater monitoring plan that will be prepared during the remedial design. However, traditional sampling techniques currently in use at HPS are envisioned for monitoring at POM wells. The Navy does not plan to collect samples beneath the surface of the bay, as discussed in the web links referenced in the comment.
		<p>In summary we request that at the very least, the Navy establish a groundwater to surface water POC location on the shoreline of Parcel B, or as I describe at a "lands end" location. Monitoring techniques can include traditional monitoring wells, time-integrated samplers (i.e., diffusion samplers), push pore water samplers, multi-level monitoring points, and/or seepage drums.</p>	<ul style="list-style-type: none"> • The Navy proposes to sample groundwater at POM monitoring wells near the shoreline. The analytical results for the groundwater sample obtained at a POM well can be compared against the trigger levels estimated for that specific location to identify whether additional evaluations are necessary. One or more of the four additional evaluations discussed earlier in this response will be undertaken if the result for a groundwater sample collected at a POM well exceeds a trigger level.

TABLE L-4: DRAFT RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2b.	---	<p><u>Testing the Groundwater Model for the Near-shore Environment</u></p> <p>We are generally pleased with the groundwater model but request that the groundwater model be tested near the Parcel B shore through the collection and analysis of representative groundwater samples. The current approach relies on back-calculated source area trigger concentrations as the benchmark for making monitoring and corrective action decisions with no testing of near shore trigger COC concentrations.</p>	<ul style="list-style-type: none"> One of the options to be considered if the result for a groundwater sample exceeds a trigger level is to monitor groundwater at a location farther downgradient. The Navy will consider collecting additional samples, including from newly installed wells, as necessary, depending on the unique situation surrounding the trigger level that is exceeded. Data already exist to demonstrate that the trigger level modeling approach is extremely conservative. For example, concentrations of chromium VI downgradient from the source location (well IR10MW12A) indicate much lower concentrations of chromium VI than were predicted by the trigger level model. A trigger level of 225 µg/L was proposed for chromium VI at former well IR10MW12A based on modeling results that indicate the concentration of chromium VI would decline to 50 µg/L when the groundwater reached the bay about 400 feet downgradient. In fact, a concentration of chromium VI of 0.86 µg/L was measured in a groundwater sample collected in May 2007 at well IR10MW82A, located 13 feet downgradient from well IR10MW12A. The trigger level model would predict a much higher concentration of chromium VI at the location of well IR10MW82A. Other attenuation processes beyond hydrodynamic dispersion are likely occurring.
3.	---	<p><u>Evaluating Groundwater Impacts to San Francisco Bay</u></p> <p>Appendix I, Section I2.3.3 (in the Parcel D Draft Final Revised FS) states the "... Water Board does not have a formal written policy regarding how to address the dilution in chemical concentrations when groundwater discharges to a surface water body". We do not agree with this statement and request that it be removed because the discharge of contaminated groundwater to surface water violates the provisions of State Water Resources Control Board Resolutions 68-16 (Statement of Policy with Respect to Maintaining High Quality Waters in California) and 92-49 (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304).</p>	<ul style="list-style-type: none"> The text in Section I4.3.3 in Appendix I of the draft final TMSRA was revised as follows: "The Water Board does not have a formal written policy on how to address chemical concentrations in groundwater prior to discharge to a surface water body. However, the Water Board has allowed..." The Navy disagrees with the Water Board on the applicability of Resolutions 68-16 and 92-49 to the discharge of groundwater to the bay. Section C2.2.1.2 in Appendix C contains the "agree to disagree" text related to the applicability of these resolutions.

TABLE L-4: DRAFT RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
3. (cont.)	---	<p>Furthermore, this statement is unsupported by our Environmental Screening Levels (“ESLs”) staff document (Water Board 2005). This document provides staff a means to help expedite the preparation of environmental risk assessments. In the case of a threat to a surface water habitat, the screening levels consider the potential bioaccumulation of chemicals in aquatic organisms and subsequent human consumption of these organisms. The groundwater screening levels for potential impacts to aquatic habitats do not consider dilution of groundwater upon discharge to a body of surface water. Benthic flora and fauna communities situated below or at the groundwater/surface water interface are assumed to be exposed to the full concentration of chemicals in impacted groundwater. Use of a generic “dilution factor” to adjust the surface water protection screening levels with respect to dilution of groundwater upon discharge to surface water was not considered in the ESLs, although site-specific attenuation factors may be appropriate on a site-specific basis.</p> <p>In keeping with the ESLs, we have allowed the Navy to model groundwater attenuation and have remained focused on those priority pollutants (e.g., mercury, lead, copper, nickel, PCBs, and pesticides) which pose bioaccumulation concerns for San Francisco Bay.</p>	<ul style="list-style-type: none"> The development of the trigger level approach was intentionally conservative to provide protection for aquatic organisms in the bay.

TABLE L-5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the City and County of San Francisco (City) on the “Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated June 22, 2007. Comments were submitted by Amy Brownell (City) on July 23, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the draft final TMSRA, even though some of these numbers have changed in the final TMSRA.

No.	Page	Comment	Response
General Comments			
1.	---	We assume that many of the detailed technical comments made regarding the Draft TMSRA that have not been addressed in the Draft Final were deemed by the Navy to not fall within the scope of the TMSRA but will be taken into consideration either during the development of the future remedial design, proposed plan, and ROD Amendment, based on the status of Parcel B at that time (e.g., performance standards for vapor barriers to mitigate VOC exposure via indoor air inhalation pathway) or during development of the Parcel B RMP (e.g., maintenance requirements for covers)	<ul style="list-style-type: none"> • The Navy will address detailed technical comments in an appropriate future document such as the remedial design or in comments on the City’s risk management plan (RMP). • The report was not changed as a result of this comment.
2.	---	It is disappointing that a number of the suggestions regarding the Draft TMSRA provided previously pertaining to document readability and clarity (e.g., grid-by-grid discussion of risk and rationale for excavation versus capping) have not been implemented. Nevertheless, a number of the “big picture” concerns, such as coordination of the Risk Management Plan with the final remedy, have been addressed in the Draft Final TMSRA. We assume that the remaining “big picture” concerns, such as the future decision process for VOCs in groundwater (see p. 21 of City/Lennar/T&R/MACTEC comments), will be addressed in a future document.	<ul style="list-style-type: none"> • The Navy will address remaining concerns, including the decision process for VOCs in soil and groundwater, in an appropriate future document such as the proposed plan, ROD amendment, or remedial design. • The report was not changed as a result of this comment.

TABLE L-5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
Comment on Need for Soil Gas Surveys			
3.	---	In several previous meetings, we have discussed the need for a soil gas survey to further evaluate potential concerns regarding indoor air quality. Although data have not been collected which could be used to evaluate indoor air quality as a result of VOCs in soil, evaluation of indoor air quality should still be identified as a Remedial Action Objective for Soil in the TMSRA. The absence of data with which to evaluate this objective should be identified as a data gap, and the intent to collect these data should be noted. Additionally, the TMSRA should specifically state that indoor inhalation via vapor intrusion from soil was not evaluated as an exposure pathway in the risk assessment. Further, the TMSRA should state that additional excavation areas may be identified based on the results of the soil vapor survey.	<ul style="list-style-type: none"> The text of Section 4.1 was revised to add the following remedial action objective (RAO) for soil gas: Prevent exposure to VOCs in soil gas at concentrations that would cause unacceptable risk via indoor inhalation of vapors. Remediation goals for soil gas will be established during the remedial design. Appendix A already states that indoor inhalation via vapor intrusion from soil was not evaluated as an exposure pathway in the risk assessment. See the fourth item under Data Evaluation on Table A-25, Summary of Uncertainties: "Subsurface soil data for VOCs were not used to evaluate subsurface vapor intrusion to indoor air."
Comments on Appendix D			
4.	---	Remediation cost estimates are missing regulatory review and oversight costs (e.g., DTSC, RWQCB, EPA), for which the Navy can expect to be billed.	<ul style="list-style-type: none"> Costs incurred by non-Navy entities for review and oversight are not integral components of the remediation alternatives and no costs will be provided. The report was not changed as a result of this comment.
5.	---	Cost estimate for Alternative S-5 includes the capital cost of \$231,188 for expanding the existing SVE system, but no operation and maintenance costs for the SVE system.	<ul style="list-style-type: none"> The SVE system is expected to operate only for 1 year, and operation and maintenance costs for that period are included in the capital cost. Section D6.4, item 10, provides additional information related to the SVE system operation. The report was not changed as a result of this comment.
6.	---	Cost estimates for all alternatives still include estimated costs for long-term O&M of institutional controls that are substantially lower than current industry experience.	<ul style="list-style-type: none"> The Navy believes that the overall remedial alternative costs are within the +50 to -30 percent accuracy range that is the target for feasibility studies. Costs for institutional controls are similar under all the remediation alternatives; therefore, adjusting the cost for institutional controls will affect all the alternatives similarly and will not change the overall comparative analysis. The report was not changed as a result of this comment.

TABLE L-5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
Comments on Section 4.3.2.1 – Pages 4-17 through 4-20			
7.	4-17 to 4-20	<p>Rather than providing comments on the Institutional Control language that was submitted on pages 4-17 through 4-20 of the Draft Final Parcel B TMSRA, we are providing revisions to the language that the Navy counsel provided to the City and Lennar counsel a few weeks ago (Attachment 1). We appreciate the Navy's providing us with alternative language in response to our prior comments and particularly appreciate the efforts of the Navy and all the agency counsels to address our comments. Our additional revisions to the Navy provided language are intended to address a few points where we felt some further clarification was needed. We look forward to discussion with the Navy to resolve these few additional issues.</p> <p>Our proposed language is as follows:</p> <p>Institutional Controls in General</p> <p>Institutional controls are legal and administrative mechanisms used to implement land use restrictions that are used to limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances present on the property, and to ensure the integrity of the remedial action. Institutional controls are required on a property where the selected remedial clean-up levels result in contamination remaining at the property above levels that allow for unlimited use and unrestricted exposure. Institutional controls would likely remain in place unless the remedial action taken would allow for unrestricted use of the property. Implementation of institutional controls includes requirements for monitoring and inspections and reporting to ensure compliance with land use or activity restrictions.</p> <p>Legal mechanisms include proprietary controls such as restrictive covenants, negative easements, equitable servitudes, and deed notices. Administrative mechanisms include notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that are intended to ensure compliance with land use or activity restrictions.</p>	<ul style="list-style-type: none"> • The Navy has continued to coordinate with the City and the regulatory agencies on the text included in the TMSRA related to institutional controls. The text included in the final TMSRA was agreed upon by attorneys for the City and the regulatory agencies and varies slightly from the version presented in the City's comment. • Please refer directly to Section 4.3.2.1 of the TMSRA for the text related to institutional controls.

TABLE L-5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
7. (cont.)	4-17 to 4-20	<p>The Navy has determined that it will rely upon proprietary controls in the form of environmental restrictive covenants as provided in the “Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control” and attached covenant models (Navy and DTSC 2000) (hereinafter referred to as “Navy/DTSC MOA”). Appendix G contains the Navy/DTSC MOA.</p> <p>More specifically, land use and activity restrictions will be incorporated into and implemented through three legal documents:</p> <ol style="list-style-type: none"> 1. Restrictive covenants included in one or more Quitclaim Deeds from the Navy to the property recipient. 2. Restrictive covenants included in one or more “Covenant to Restrict Use of Property” entered into by the Navy and DTSC as provided in the Navy/DTSC MOA and consistent with the substantive provisions of Cal. Code Regs. Title 22 § 67391.1. 3. A Risk Management Plan prepared by the City and County of San Francisco and approved by the Navy and FFA Signatories, which shall be attached to and incorporated by reference into the Covenant(s) to Restrict Use of Property and Deed(s) as an enforceable part thereof. <p>The “Covenant(s) to Restrict Use of Property” will incorporate the land use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC against future transferees. The Quitclaim Deed(s) will include the identical land use and activity restrictions in environment restrictive covenants that run with the land and that will be enforceable by the Navy against future transferees.</p> <p>The Parcel B Risk Management Plan (“Parcel B RMP”) shall specify soil and groundwater management procedures for compliance with the remedy selected in the Parcel B ROD amendment. The Parcel B RMP shall identify the roles of local, state, and federal government in administering the Parcel B RMP and shall included, but not be limited to, procedures for any necessary sampling and analysis requirements, worker health and safety requirements, and any necessary site-specific construction and/or use approvals that may be required.</p>	(see above)

TABLE L-5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
7. (cont.)	4-17 to 4-20	<p><u>Access</u></p> <p>The Deed and Covenant shall provide that the Navy and FFA Signatories and their authorized agents, employees, contractors and subcontractors shall have the right to enter upon HPS Parcel B to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain any response or remedial action as required or necessary under the cleanup program, including but not limited to monitoring wells, pumping wells, treatment facilities, and cap containment systems.</p> <p><u>Implementation</u></p> <p>The Navy shall address/describe institutional control implementation and maintenance actions including periodic inspections and reporting requirements in the preliminary and final remedial design (RD) reports to be developed and submitted to the FFA Signatories for review pursuant to the FFA (see "Navy Principles and Procedures for Specifying, Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" attached to January 16, 2004 DoD memorandum titled "Comprehensive Environmental Response, Compensation and Liability Act [CERCLA] Record of Decision [ROD] and Post-ROD Policy"). The preliminary and final RD reports are primary documents as provided in Section 7.3 of the FFA.</p> <p>Activity Restrictions that Apply Throughout Parcel B</p> <p>The following sections describe the institutional control objectives to be achieved through activity restrictions throughout Parcel B in order to ensure that any necessary measures to protect human health and the environment and the integrity of the remedy have been undertaken.</p> <p><u>Restricted Activities</u></p> <p>The following restricted activities throughout HPS Parcel B must be conducted in accordance with the "Covenant(s) to Restrict Use of Property", Quitclaim Deed(s), the Parcel B RMP and if required, any other workplan or document approved in accordance with these referenced documents.</p>	

TABLE L-5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
7. (cont.)	4-17 to 4-20	<p>a. “Land disturbing activity” which includes but is not limited to: (1) excavation of soil, (2) construction of roads, utilities, facilities, structures, and appurtenances of any kind, (3) demolition or removal of “hardscape” (for example, concrete roadways, parking lots, foundations, and sidewalks), (4) any activity that involves movement of soil to the surface from below the surface of the land, and (5) any other activity that causes or facilitates the movement of known contaminated groundwater.</p> <p>b. Alteration, disturbance, or removal of any component of a response or cleanup action (including but not limited to pump-and-treat facilities, revetment walls and shoreline protection, and soil containment systems); groundwater extraction, injection, and monitoring wells and associated piping and equipment; or associated utilities.</p> <p>c. Extraction of groundwater and installation of new groundwater wells.</p> <p>d. Removal of or damage to security features (for example, locks on monitoring wells, survey monuments, fencing, signs, or monitoring equipment and associated pipelines and appurtenances).</p> <p><u>Prohibited Activities</u> The following activities are prohibited throughout HPS Parcel B:</p> <p>a. Growing vegetables or fruits in native soil for human consumption</p> <p>b. Use of groundwater.</p> <p>Activity restrictions Relating to VOC Vapors at Specific Locations within Parcel B. Any proposed construction of enclosed structures must be approved, in accordance with the “Covenant to Restrict Use of the Property,” Quitclaim Deed, and Parcel B RMP prior to the conduct of such activity within the area requiring institutional controls (ARIC) for VOC vapors in order to ensure that the risks of potential exposures to VOC vapors are reduced to acceptable levels that are adequately protective of human health. Initially, the ARIC will include all of Parcel B except Redevelopment Block 4. This can be achieved through engineering controls or other design alternatives that meet the specifications set forth in the ROD amendment, RD reports, land use control remedial design (LUC RD) report, and Parcel B RMP.</p>	

TABLE L-5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
7. (cont.)	4-17 to 4-20	<p>The ARIC may be modified by the FFA Signatories as the soil contamination areas and groundwater contaminant plumes that are producing unacceptable vapor inhalation risks are reduced over time or in response to further soil, vapor, and groundwater sampling and analysis for VOCs that establishes that areas now included in the ARIC do not pose an unacceptable potential exposure risk to VOC vapors.</p> <p>Additional Land Use Restrictions for IR Sites 7 and 18</p> <p>The following restricted land uses for property in IR Sites 7 and 18 must be reviewed and approved by the FFA Signatories in accordance with the "Covenant(s) to Restrict Use of the Property," Quitclaim Deed(s) and Parcel B RMP prior to use of the property for any of the restricted uses:</p> <ul style="list-style-type: none"> a. A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation, b. A hospital for humans, c. A school for persons under 21 years of age, or d. A day care facility for children. 	

TABLE L-6: DRAFT RESPONSES TO COMMENTS FROM COMMUNITY FIRST COALITION ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from Community First Coalition on the “Draft Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated June 22, 2007. Comments were submitted by Raymond Tompkins on July 23, 2007. Throughout this table, *italicized* text represents additions to the TMSRA and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the draft final TMSRA, even though some of these numbers have changed in the final TMSRA.

No.	Page	Comment	Response
Comments Regarding Remedial Alternatives for Soil			
1.	---	<p>The remedial alternatives for soil include the following:</p> <p>S-1 No Action</p> <p>S-2 Institutional Controls, Maintained Landscaping, and Shoreline Revetment</p> <p>S-3 Excavation, Methane and Mercury Source Removal, Disposal, Institutional Controls, Maintained Landscaping, and Shoreline Revetment</p> <p>S-4 Covers, Methane and Mercury Source Removal, Institutional Controls, and Shoreline Revetment</p> <p>S-5 Excavation, Methane and Mercury Source Removal, Disposal, Covers, Soil Vapor Extraction, Institutional Controls, and Shoreline Revetment</p> <p>The intended use of this parcel is for: (1) research and development, (2) mixed use, (3) educational/cultural activities, and (4) open space, and hence the parcel must be cleaned up to residential standards for 1 and 2, industrial standards for 3 and recreational standards for 4. Given that all of these activities are intermixed in this parcel, we believe that option S-5 would be the most attractive from the standpoint of long term protection of the environment and future residents and workers on this parcel. We believe that this option has the best cost to benefit ratio and is ranked as such by the Navy in Table 6-2 of the TMSRA.</p>	<ul style="list-style-type: none"> • The Navy will consider comments related to selection of the preferred alternative during the public comment period on the proposed plan. The Navy encourages the commentors to resubmit this comment during the public comment period, which is currently scheduled to occur in May 2008. • The report was not changed as a result of this comment.

TABLE L-6: DRAFT RESPONSES TO COMMENTS FROM COMMUNITY FIRST COALITION ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2.	---	<p>We do have concerns with the use of covers (i.e., buildings, parking lots, etc.) as although these provide protection to the people and the environment in an upwardly mobile regime (outgassing), they do not guard against infiltration which can lead to leaching of soil contaminants into groundwater and ultimately into the Bay and the surrounding ecosystem. Moreover, given the low elevation of this site (0-10' above sea level), the likelihood of rising sea levels due to global warming, and potentially significant flooding in the future, excavation, removal, and disposal of the most contaminated portions of this parcel would again provide the best long term protection. The Navy document notes that the details of the shoreline revetment will occur during the remedial design (TMSRA page 5-3), and hopefully these points will be raised at that time.</p>	<ul style="list-style-type: none"> Quarterly groundwater monitoring at Parcel B since 1999 has not indicated that leaching of contaminants from soil into groundwater is a significant concern at Parcel B. Contaminants that may remain in place in soil have not affected groundwater to date to any significant degree and are not expected to affect groundwater in the future. The majority of the fill at Parcel B has been in place since the 1940s and, therefore, has had more than 60 years to reach an equilibrium condition with infiltrating surface water. The Navy is committed to protecting the integrity of the covers and the shoreline revetment against breaches caused by erosion or flooding. The designs for the covers and revetment will consider the potential for future flooding. The Navy removed the most highly contaminated soil at Parcel B during the 1999 to 2001 remedial action, when more than 100,000 cubic yards of soil was excavated and disposed of off site. The report was not changed as a result of this comment.
Comments Regarding Remedial Alternatives for Groundwater			
1.	---	<p>The remedial alternatives for groundwater include the following:</p> <p>GW-1 No Action</p> <p>GW-2 Long-Term Groundwater Monitoring and Institutional Controls</p> <p>GW-3A <i>In Situ</i> Treatment (Bioremediation), Groundwater Monitoring and Institutional Controls</p> <p>GW-3B <i>In Situ</i> Treatment (Zero-Valent Iron), Groundwater Monitoring and Institutional Controls</p> <p>Using the same logic as we have used in our comments regarding remedial alternatives for soil, we believe that the alternatives outlined in options GW-3A / GW-3B would be the most attractive from the standpoint of long term protection of the environment. The TMSRA notes the presence of a chromium VI plume, a VOC plume on this parcel with the addition of two VOC plumes on Parcel C that have encroached at times into Parcel B. The TMSRA documents the use of Bioremediation (by lactate injection) and Zero-Valent Iron injection in previous attempts to remediate and reduce VOCs in groundwater at this and/or other sites in the shipyard.</p>	<ul style="list-style-type: none"> The Navy will consider comments related to selection of the preferred alternative during the public comment period on the proposed plan. The Navy encourages the commentors to resubmit this comment during the public comment period, which is currently scheduled to occur in May 2008. The report was not changed as a result of this comment.

TABLE L-6: DRAFT RESPONSES TO COMMENTS FROM COMMUNITY FIRST COALITION ON THE DRAFT FINAL PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
1. (cont.)	---	While it is difficult to hypothesize which of these options would be the most effective in terms of reducing VOC contamination in groundwater in this particular case, we believe that the Navy should not be limited to the use of simply one or the other. We encourage flexibility by utilizing a combination of options GW-3A and GW-3B to optimize the outcome. Continued attention to ongoing evaluation of data on the use of Zero-Valent Iron in Parcel C and Bioremediation in the IR-10 area in Parcel B should provide more evidence to support the most effective methodology for this particular case.	(see above)
2.	---	The native serpentine rock used as fill materials in constructing this parcel contains environmentally significant concentrations of naturally occurring metals such as arsenic and manganese. The Navy acknowledges that other metals such as chromium and lead in the soil may be due to anthropogenic activities such as metal plating and ship repair activities. Although these metals could have adverse toxicological impact on the ecosystem, we believe that the Navy is applying the most recent and stringent standards in their risk assessment models, and their proposed plans to remediate this parcel include appropriate institutional controls and options that should adequately protect residents, construction workers and the ecosystem from these metals. We realize that although most of these metals are not highly mobile under the soil conditions present at this site, continued groundwater monitoring for these contaminants of concern would enable confirmation of this and we encourage the Navy to do so. In regards to mercury, options S-3, S-4, and S-5 address removal of specific source locations where this metal has been found in groundwater at concentrations exceeding the appropriate limits. If the Navy utilizes option S-5, as we advise, groundwater mercury concentration levels should decrease to ambient and acceptable levels, thus protecting human health and the environment.	<ul style="list-style-type: none"> • Groundwater monitoring is proposed only for areas that pose unacceptable risk to human health or the environment. The Navy is pleased that the community is actively involved in the evaluation of remedial alternatives for soil and groundwater. • The report was not changed as a result of this comment.

REFERENCES

- CE2-Kleinfelder Joint Venture. 2006. "Parcel B Quarterly Groundwater Monitoring Report (October-December 2005) and Annual Report (2005), Hunters Point Shipyard, San Francisco, California." October.
- CE2-Kleinfelder Joint Venture. 2007a. "Parcel B Quarterly Groundwater Monitoring Report (January-March 2006), Revision 1, Hunters Point Shipyard, San Francisco, California." March.
- CE2-Kleinfelder Joint Venture. 2007b. "Parcel B Quarterly Groundwater Monitoring Report (April-June 2006), Revision 1, Hunters Point Shipyard, San Francisco, California." April.
- CE2-Kleinfelder Joint Venture. 2007c. "Parcel B Quarterly Groundwater Monitoring Report (July-September 2006), Revision 1, Hunters Point Shipyard, San Francisco, California." May.
- CE2-Kleinfelder Joint Venture. 2007d. "Parcel B Quarterly Groundwater Monitoring Report (October-December 2006) and Annual Report, Revision 1, Hunters Point Shipyard, San Francisco, California." October.
- CE2-Kleinfelder Joint Venture. 2007e. "Parcel B Quarterly Groundwater Monitoring Report (January-March 2007), Revision 1, Hunters Point Shipyard, San Francisco, California." November.
- Kleinfelder. 2006a. "January to March 2005, Twenty-first Quarterly Groundwater Sampling Report, Parcel B, Hunters Point Shipyard, San Francisco, California." April 28.
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- Kleinfelder. 2006c. "July to September 2005, Twenty-third Quarterly Groundwater Sampling Report, Parcel B, Hunters Point Shipyard, San Francisco, California." November 7.
- Tetra Tech EM Inc. (Tetra Tech). 2001. "Final Remedial Design Documents Amendment, Parcel B, Hunters Point Shipyard, San Francisco, California." February 20.
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- U.S. Department of the Navy (Navy). 2007. Letter regarding Navy's position on issues relating to the Parcel B TMSRA. From Mr. Keith Forman, Base Realignment and Closure Environmental Coordinator. To Base Realignment and Closure Cleanup Team. May 18.

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EPA. 2002b. "Calculating Exposure Point Concentrations at Hazardous Waste Sites." Office of Solid Waste and Emergency Response 9285.6-10. Office of Emergency and Remedial Response. Washington, DC. December.

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TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
65.	6-3 & C-32	Section 6.1.1.2, Compliance with ARARs: Alternative S-1, Page 6-3 and Section C.4.1., Alternative S-1 – No Action, Page C-32: The text in Section 6 and Appendix C regarding whether the no action alternative complies with ARARs is inconsistent. Section 6.1.1.2 states that the “[b]ecause no action is proposed, this alternative does not comply with ARARs.” The text in Section C4.1.1 indicates that “[t]here is no need to identify action-specific ARARs for the no action alternative because ARARs apply to ‘any removal or remedial action conducted entirely on-site’ and ‘no action’ is not a removal or remedial action.... Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.” Please revise all references to whether the No Action alternative complies with ARARs in Section 6 and Appendix C to be consistent.	<ul style="list-style-type: none"> The text in Section 6.1.1.2 on page 6-3 will be replaced with the following text to be consistent with the text in Section C4.1.1. <i>“There is no need to identify ARARs for the no-action alternative because ARARs apply to ‘any removal or remedial action conducted entirely on-site’ and ‘no action’ is not a removal or remedial action. CERCLA § 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). Therefore, a discussion of compliance with ARARs is not appropriate for this alternative.”</i> A similar change will be made to the text of Section 6.3.1.2 on page 6-18.
66.	6-6	Section 6.1.2.4, Reduction of Toxicity, Mobility, or Volume through Treatment: Alternative S-2, Page 6-6: The TMSRA rates Alternative S-2 “good” in terms of reduction of toxicity, mobility, or volume through treatment, but this alternative does not include treatment. Since this criterion is intended to evaluate alternatives in terms of USEPA’s preference for treatment (i.e., destruction or transformation of contaminants) over containment or removal, an alternative which does not include treatment should not be rated “good” for this criterion. Please revise the TMSRA to rate Alternative S-2 “poor” in terms of reduction of toxicity, mobility, or volume through treatment.	<ul style="list-style-type: none"> Section 6.1.2.4 on page 6-5 will be replaced with the following paragraph: <i>“Alternative S-2 includes institutional controls and shoreline revetment. This alternative does not include treatment that would result in the destruction, transformation, or irreversible reduction in contaminant mobility. Therefore, the overall rating for Alternative S-2 for the reduction of toxicity, mobility, and volume through treatment is poor.”</i> Tables ES-1 and 6-2 and Section 6.2 will be updated with the rating for Alternative S-2. The overall rating for the alternative will also be updated in the tables and the text of the report.
67.	6-8	Section 6.1.3.4, Reduction of Toxicity, Mobility, or Volume through Treatment: Alternative S-3, Page 6-8: The TMSRA rates Alternative S-3 “very good” in terms of reduction of toxicity, mobility, or volume through treatment, but this alternative does not include treatment. Since this criterion is intended to evaluate alternatives in terms of USEPA’s preference for treatment (i.e., destruction or transformation of contaminants) over containment or removal, an alternative which does not include treatment should not be rated “very good” for this criterion. Please revise the TMSRA to rate Alternative S-3 “poor” in terms of reduction of toxicity, mobility, or volume through treatment.	<ul style="list-style-type: none"> Section 6.1.3.4 on page 6-8 will be replaced with the following paragraph: <i>“Alternative S-3 includes excavation of contaminated soil, methane and mercury source removal, shoreline revetment, and institutional controls. However, this alternative does not include treatment that would result in the destruction, transformation, or irreversible reduction in contaminant mobility. Therefore, the overall rating for Alternative S-3 for the reduction of toxicity, mobility and volume through treatment is poor.”</i> Tables ES-1 and 6-2 and Section 6.2 will be updated with the rating for Alternative S-3. The overall rating for the alternative will also be updated in the tables and the text of the report.

TABLE 1: DRAFT RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
68.	6-11	<u>Section 6.1.4.4. Reduction of Toxicity, Mobility, or Volume through Treatment: Alternative S-4, Page 6-11:</u> The TMSRA rate Alternative S-4 “good” in terms of reduction of toxicity, mobility, or volume through treatment, but this alternative does not include treatment. Since this criterion is intended to evaluate alternatives in terms of USEPA’s preference for treatment (i.e., destruction or transformation of contaminants) over containment or removal, an alternative which does not include treatment should not be rated “good” for this criterion. Please revise the TMSRA to rate Alternative S-4 “poor” in terms of reduction of toxicity, mobility, or volume through treatment.	<ul style="list-style-type: none"> Section 6.1.4.4 on page 6-11 will be replaced with the following paragraph: <i>“Alternative S-4 includes covers over contaminated soil, excavation, methane and mercury source removal, shoreline revetment, and institutional controls. However, this alternative does not include treatment that would result in the destruction, transformation, or irreversible reduction in contaminant mobility. Therefore, the overall rating for Alternative S-4 for the reduction of toxicity, mobility, and volume through treatment is poor.”</i> Tables ES-1 and 6-2 and Section 6.2 will be updated with the rating for Alternative S-4. The overall rating for the alternative will also be updated in the tables and the text of the report.
69.	6-14	<u>Section 6.1.5.5. Short-Term Effectiveness: Alternative S-5, Page 6-14:</u> This section states that the time required to complete the remedial action is less than 1 year, and the effects of implementing this alternative would be nearly immediate; however, it is not clear whether this time frame includes completion of SVE. Please revise this section to discuss the anticipated duration of SVE.	<ul style="list-style-type: none"> The estimate of 1 year to complete the remedial action includes 1 year of SVE operation and monitoring during that operation. This assumption is listed as item 10 in Section D6.4 of Appendix D. The following text will be added to the end of this item. <i>“The SVE operation period of 1 year includes the monitoring period associated with the system operation.”</i>
70.	6-17	<u>Section 6.2.8. Overall Rating of Soil Alternatives, Page 6-17:</u> The TMSRA concludes that Alternative S-3 is more protective than S-2, and it is rated higher than S-2 in Table 6-2; however, if all criteria are weighted equally, it appears that Alternatives S-2 and S-3 rank equally except for cost. Since S-3 is more expensive than S-2, it should actually rank lower than S-2. Please revise the TMSRA to assign an overall rank of “good” to S-3 and “very good” to S-2 to be consistent with the results of the evaluation by criteria.	<ul style="list-style-type: none"> The overall rating for Alternative S-3 will be changed to “good” in Sections 6.1.3, 6.1.3.8, and 6.2.8. Likewise, the rating for Alternative S-3 in Tables ES-1 and 6-2 will be updated.
71.	6-20	<u>Section 6.3.2.1. Overall Protection of Human Health and the Environment: Alternative GW-2, Page 6-20:</u> The TMSRA concludes that Alternative GW-2 would be protective of human health and the environment, but the potential risks from contaminated groundwater that migrates to San Francisco Bay remains unchanged. Please revise the TMSRA to clarify how Alternative GW-2 will be protective of the environment and meet RAOs given that the alternative will not prevent migration of contaminated groundwater to San Francisco Bay.	<ul style="list-style-type: none"> Mercury source removal will be added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59. In addition, the beneficial impact of mercury source removal will be assessed by ongoing groundwater monitoring for mercury. Please refer to the response to EPA specific comment 61 and DTSC (Lanphar) specific comment 58. No other chemicals were considered to pose unacceptable risk based on migration of groundwater to the surface water of the bay. Follow-up: The clean fill used to backfill the excavation that will deepen Excavation EE-05 will act as a sink for mercury dissolved in groundwater based on the high sorptive capacity of the clean material.

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72.	6-20	<u>Section 6.3.2.3, Long-Term Effectiveness and Permanence: Alternative GW-2, Page 6-20:</u> It is unlikely that the concentration of mercury will decrease due to natural recovery or that groundwater containing mercury will be prevented from impacting the Bay. Apparent decreases in mercury concentration are likely due to sampling techniques and handling practices, since dissolved mercury will volatilize from groundwater when it is exposed to air. Please explain the mechanism for natural recovery of mercury or state that the mercury in groundwater at IR-26 will not be affected by natural recovery and reduce the rating of this alternative accordingly.	<ul style="list-style-type: none"> Mercury source removal will be added to Alternative S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59. In addition, the beneficial impact of mercury source removal will be assessed by ongoing groundwater monitoring for mercury. Please refer to the response to EPA specific comment 61 and DTSC (Lanphar) specific comment 58.
73.	6-23 & 6-24	<u>Section 6.3.3.5, Short-Term Effectiveness; Alternatives GW-3A and 3B, Pages 6-23 and 6-24:</u> It appears that short-term effectiveness is ranked too high because of the potential that toxic intermediate products like vinyl chloride will be produced. Please discuss the potential for production of toxic intermediates, explain how this will be addressed and revise the ranking for Alternatives GW-3A and 3B to account for the potential that toxic intermediates will be produced.	<ul style="list-style-type: none"> Please refer to the responses to EPA specific comments 51 and 63.
74.	6-24	<u>Section 6.3.3.6, Implementability: Alternatives GW-3A and 3B, Page 6-24:</u> According to the information presented in the TMSRA, preferential pathways, daylighting at the surface, and discharge to San Francisco Bay were problems when substrates were injected during treatability studies; however, these issues are not discussed in the evaluation of Alternatives GW-3A and 3B. Please revise the TMSRA to discuss implementability issues associated with injection of substrate at Parcel B and change the rating for implementability from “very good” as appropriate.	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 62. Section 6.3.3.6 on page 6-24 states “The major difficulty with implementing injection technologies during pilot studies at HPS has been mass transfer of the treatment substrate to the contaminants. Data from pilot studies as well as the lithology of the treatment area would be used to select sufficient injection points for treatment additives to optimize the success of the injection.” Although the results of the pilot studies suggest that the geology of the site makes it difficult to inject large amounts of ZVI or bioremediation substrates, the pilot studies have been successful in reducing the concentrations of contaminants in the treatment area. The remedial design will take into account the reduced injection pressures and radius of influence for these technologies at Parcel B. No changes to the report are proposed from this comment.

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75.	6-26	<u>Section 6.4.4, Reduction of Toxicity, Mobility, or Volume through Treatment, Page 6-26:</u> The fourth sentence states, “Neither Alternative GW-1 nor Alternative GW-2 would reduce the toxicity, mobility, or volume of contaminants in the groundwater, other than through natural recovery, but natural recovery cannot be assumed for the No Action alternative (GW-1) because there is no way to verify that it is occurring. Please revise the text to clearly state that Alternative GW-1 will not reduce toxicity, mobility or volume of contaminants through treatment.	<ul style="list-style-type: none"> Section 6.4.4 on page 6-26 will be revised as follows. “Exposure to these contaminants...through institutional controls and groundwater monitoring. Neither Alternative GW-1 nor Alternative GW-2 would reduce the toxicity, mobility, or volume of contaminants in the groundwater <i>through treatment</i>, other than through the natural recovery of the aquifer. Alternative GW-2 would not reduce the toxicity or volume of contaminants, but would monitor the mobility...”
76.	---	<u>Table 6-2, Ranking of Remedial Alternatives for Soil and Groundwater:</u> The rankings in this table should be changed to correspond to any changes to rankings in the text. For example, the ranking for reduction of toxicity, mobility or volume through treatment should be changed to “poor” for Alternatives S-2, S-3, and S-4. Furthermore, Alternative S-3 should be ranked the same or lower than Alternative S-2 based on the evaluation by criteria. Please revise this table to be consistent with the text as appropriate.	<ul style="list-style-type: none"> Tables ES-1 and 6-2 and Sections 6.2 and 6.4 will be updated with the changes to the rankings from EPA specific comments 63, 66, 67, 68, and 70.
General Comments, Appendix A, Parcel B Human Health Risk Assessment			
1.	---	To the greatest extent practicable, the risk assessment should represent a stand-alone document. Every effort should be made to include relevant information within this section of a greater document. Though not substantive with respect to technical adequacy or potential to impact subsequent risk management decisions, the HHRA should contain a fundamental presentation of current and historical land use as a basis for evaluating efficacy of the Exposure Assessment.	<ul style="list-style-type: none"> Section A1.0 will be revised to include a brief description of historical and current land use as follows. <i>“HPS operated as a commercial dry dock facility from about 1867 until 1940 when the Navy acquired title to the land and began developing it for various shipyard activities. From 1945 to 1974, the Navy used the shipyard primarily as a maintenance and repair facility. The Navy discontinued activities at HPS in 1974 and the shipyard remained relatively unused until 1976. In 1976, the Navy leased most of HPS, including all of the area now known as Parcel B, to the Triple A Machine Shop (Triple A). Triple A operated a commercial ship repair facility from July 1976 to June 1986, but did not vacate the property until March 1987. During the lease period, Triple A used dry docks, berths, machine shops, power plants, various offices, and warehouses to repair commercial and Navy vessels. Triple A also subleased portions of the property to various other businesses. The Navy resumed occupancy of HPS in 1986.</i>

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			<ul style="list-style-type: none"> Historically, the dominant land use of Parcel B has been for office and commercial buildings and light industrial production. The Navy also conducted industrial activities at Parcel B, such as fuel distribution, sandblasting, painting, machining, acid mixing, and metal fabrication. Most of Parcel B is covered with concrete or asphalt and buildings. The western portion of Parcel B, including Installation Restoration (IR) Program sites IR-07 and IR-18, is unimproved and covered only with soil and minor vegetation. Based on the City of San Francisco's reuse plan (San Francisco Redevelopment Agency 1997), Parcel B is expected to be zoned to accommodate mixed uses, including a mixed residential/retail area, a research and development area, a cultural and educational area, and open space. The mixed-use and research and development areas could include upper-story housing, live/work arrangements, and a variety of commercial enterprises, artist studios, retail and business services as well as residences on the ground level. The cultural and educational area could include museums. The open space areas will provide public access and use of the waterfront as well as provide a corridor for the Bay Trail (hiking and bicycle access) close to the shoreline (San Francisco Redevelopment Agency 1997). The reuse planning was incorporated into the human health risk assessment (for example, areas where residential exposure applies) together with agreements with the BCT on the HHRA methodology to evaluate risks to human health at Parcel B."
2.	---	<p>It is not acceptable to eliminate non-detect results from the risk assessment data set. Section A5.1.2, EPCs for Groundwater (Page A-18), indicates that non-detect results were not included in the contaminant exposure point concentration (EPC) calculations for groundwater. USEPA's 1989 Risk Assessment Guidance for Superfund (RAGS), Part A (RAGS, Part A) recommends the use of one-half the sample quantization limit (SQL) as a proxy concentration for non-detect results. The Navy referenced an agreement with USEPA (Section A4.1) and DTSC with respect to an approved data set for use in assessing groundwater exposures, but USEPA did not agree that procedures in RAGS can be changed. In addition, since the full data set was provided, USEPA did not approve the data set; USEPA did agree that the approach discussed in meetings and conference calls could be applied and that we would review the resulting risk assessment. Significant uncertainty is associated with consideration of historical data (inclusion of the previous</p>	<ul style="list-style-type: none"> The groundwater data set for the HHRA was based on analytical results from the last 12 rounds of sampling at the request of the BCT. Use of 12 rounds of sampling introduces significant uncertainty to the EPCs for groundwater, because sampling methods for groundwater have varied over time, and, as noted in the comment, groundwater is a dynamic medium. The calculation of EPCs for groundwater was restricted to detected results to avoid adding additional uncertainty to the EPCs. This approach limits the influence of historical nondetected results, which may be influenced by earlier sampling techniques. The exclusion of nondetected results from the calculation of groundwater EPCs may result in a potential underestimation of risks if one-half of the sample quantitation limit (SQL) for one or more of the nondetected results is elevated and exceeds the detected results. The Navy acknowledges that the analytical results for some chemicals measured in groundwater at Parcel B contain nondetected results for which the one-half of the SQL exceeds the detected

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		12 rounds of groundwater sampling) for a dynamic medium such as groundwater (TechLaw notes Section A4.2, Data Reduction). It is likely that the exclusion of the non-detect/proxy values resulted in an underestimation of the total risk. Further, contrary to this approach, in Section A5.1.1, EPCs for Soil (page A-17), the text indicates that USEPA's recommendation to use non-detect proxy values in the calculation of EPCs for soil was applied. Please revise the risk assessment to follow RAGS, Part A guidance and include one-half of the SQL as proxy concentration for non-detect results.	<p>results. To address the potential underestimate of risks associated with limiting the data set used to calculate groundwater EPCs for plume-based exposure areas to detected results, the methodology used in the HHRA to identify chemical and exposure areas of concern for groundwater will be modified to incorporate the groundwater risk results calculated using maximum concentrations as EPCs (MAX scenario). Risk calculations based on the MAX scenario were provided in Attachment A3 of the HHRA for each plume-based exposure area. If results of the MAX scenario indicate additional COCs; that is, chemicals with a cancer risk greater than 1.0E-06 or noncancer hazard index greater than 1.0 that were not identified in the reasonable maximum exposure (RME) scenario, then those COCs from the MAX scenario will be included as COCs for Parcel B and evaluated for remedial alternatives. This approach provides an additional measure of conservatism beyond incorporation of nondetected results for calculation of EPCs because risks calculated using maximum concentrations as EPCs (MAX scenario) represent worst-case scenario results. The Navy discussed this approach with BCT risk assessment staff in a conference call on August 17, 2006.</p> <ul style="list-style-type: none"> • This change would only apply to the plume-based exposure areas for groundwater (IR-10A, IR-10B, and IR-25) because groundwater EPCs for nonplume exposure areas were already based on maximum detected concentrations (see Section A5.1.2 of the HHRA).
Specific Comments, Appendix A, Parcel B Human Health Risk Assessment			
1.	A-8	<u>Appendix A, Section A4.1, Data Evaluation, Page A-8:</u> The text indicates that USEPA has agreed to the data set used in the risk assessment, but USEPA only agreed that the approach discussed in meetings and conference calls could be applied and that the resulting risk assessment would be reviewed. Please revise the last sentence of the first paragraph to state that USEPA only agreed that the approach proposed for creating the data set could be applied and that the resulting risk assessment would be reviewed.	<ul style="list-style-type: none"> • The last sentence of the first paragraph in Section A4.1 will be revised as follows. "The data set for groundwater was based on <i>the approach for the groundwater risk evaluation for HPS, as discussed in meetings with EPA, DTSC, and the Navy in 2003 and 2004.</i>"

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2.	A-18	<u>Appendix A, Section 5.1.2, EPCs for Groundwater, Page A-18</u> : This section indicates that the Lilliefors Test was used to determine the distributions for sample sizes greater than n=50. However, the first bullet point in Section A5.1.1, page A-17 indicates that the D'Agostino's Test was used for determining distributions in soil data set sample sizes greater than n=50. Please clarify why the Navy chose to use the Lilliefors Test in preference to the D'Agostino's Test for calculating EPCs in groundwater.	<ul style="list-style-type: none"> The text in Section A5.1 will be revised to clarify that EPCs for soil, including the goodness-of-fit statistical tests used to determine soil data distributions, were calculated using previous guidance provided by EPA (1992) and the methodology established for soil HHRAs for HPS (Tetra Tech 2003a, Navy 2004). This methodology involves use of the D'Agostino test to determine distributions for data sets exceeding 50 samples. For calculation of EPCs for groundwater plumes, more recent EPA methodology was used; this methodology relies on use of the ProUCL software, which incorporates the Lilliefors test, rather than the D'Agostino test, to determine distributions for data sets exceeding 50 samples (EPA 2004b).
3.	A4-3	<u>Attachment A4-Groundwater Plume Delineation Methodology, Page A4-3</u> : The second bullet point on page A4-3 states that groundwater data from monitoring wells as well as piezometers were used to delineate plumes IR-10A, IR-10B, and IR-25. However, the text in Section A4.2 (Data Reduction, page A-9) indicates that only groundwater data from monitoring wells were included in the risk evaluation for the groundwater data set. This is due to the fact that groundwater data from piezometers are less reliable than groundwater data from monitoring wells. Although Figures A4-1 through A4-3 show that data collected from piezometers resulted exclusively in non-detect concentrations and were not used to delineate any of the plumes, the text should be revised to clarify that piezometers were not used for plume delineation to maintain consistency with Section A4.2. Please resolve this discrepancy.	<ul style="list-style-type: none"> For consistency with Section A4.2, the cited bullet text in Attachment A4 will be revised as follows. <i>"Only groundwater data from monitoring wells were used to delineate risk plumes; data from piezometers were not used for plume delineation."</i>
4.	---	<u>Table A-3, Chemical Data and Uptake Factors For Ingestion of Homegrown Produce</u> : According to the footnote in Table A-3, the octanol-water partition coefficient (Kow) value for di-n-Butylphthalate of 4.0E+5 was found in USEPA's 1990 "Basics of Pump-and-Treat Groundwater Remediation Technology". However, the Kow for this compound is not presented in this source. The HHRA should clarify the source of this value.	<ul style="list-style-type: none"> The EPA (1990) source cited in Table A-3 for the Kow for di-n-butylphthalate is correct. EPA lists a Kow of 4.0E+05 for di-n-butylphthalate on page A-7 of its "Basics of Pump-and-Treat Groundwater Remediation Technology" document (EPA 1990).

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5.	---	<u>Table A-11, Slope Factors for Chemicals of Potential Concern</u> : This table indicates that the oral cancer slope factor (SF) for vinyl chloride (adult) is 7.5E-01. However, USEPA's Integrated Risk Information System (IRIS) recommends using an oral cancer slope factor of 7.2E-01. This may be a typographical error. Please clarify which value was used as the basis in any quantitative point estimate of risk.	<ul style="list-style-type: none"> Although EPA's IRIS recommends use of an oral cancer slope factor (SFo) of 7.2E-01 per milligram per kilogram per day (mg/kg-day) for evaluating risks from adult exposure to vinyl chloride (based on the linearized multistage model [LMS]), EPA Region IX uses a SFo of 7.5E-01 per mg/kg-day (based on the lower limit on effective dose [LED] 10/linear method) to calculate the preliminary remediation goal (PRG) for vinyl chloride. A footnote will be added to Table A-11 to clarify that the SFo used for vinyl chloride (7.5E-01 per mg/kg-day) is based on the EPA Region IX PRG table (EPA 2004a).
6.	---	<u>Table A-13, Groundwater Risk-Based Screening Levels</u> : This table indicates that the tap water preliminary remediation goal (PRG) for arsenic is 7.0E-3 µg/L. However, USEPA Region 9's 2004 PRG Table lists a tap water PRG value of 7.1E-03 µg/L. This may be a typographical error. Please clarify which value was used as the basis in any quantitative point estimate of risk.	<ul style="list-style-type: none"> Table A-13 will be revised to show the correct tap water PRG of 7.1E-03 µg/L for arsenic. The risk calculations for exposure to arsenic from domestic use of groundwater will be corrected accordingly to be based on the corrected PRG.
General Comments , Appendix B, Parcel B Screening-Level Ecological Risk Assessment of the Parcel B Shoreline, Sites IR-07 and IR-26 It should be noted that many of the following comments are provided to improve the TMSRA and do not represent major flaws in the risk assessment; such comments are designed to make the document clear and transparent to a new reader, as consistent with EPA policy, who may have not been party to prior risk assessment discussions between the Navy and the regulatory agencies.			
1.	---	The SLERA incorporates Step 3A, which is a refinement of chemicals of potential ecological concern (COPECs) based on less conservative assumptions. Part of Step 3A includes comparison of COPECs to background values. However, no information appears to be present in the document to discuss the appropriateness of the background data sets used for these comparisons (e.g., San Francisco Bay ambient sediment data). Although it is recognized that sufficient references are provided for the background datasets used for these comparisons, appropriate discussion should be provided in the document to detail the methodologies employed for collecting background data, locations from which background data were collected, and an overall assessment of whether collected data is actually representative of background conditions and applicable for the Step 3A process. Please revise Appendix B to include this information.	<ul style="list-style-type: none"> The San Francisco Bay ambient sediment values were developed by the Water Board and have been widely accepted by the regulatory community. A complete discussion of the methodologies employed in developing these values is provided in the following two documents: Eco Analysis, Inc. 1998. "San Francisco Bay Sediment Criteria Project Ambient Analysis Report." Prepared for: California Regional Water Quality Control Board, San Francisco Bay Region. March. San Francisco Bay Regional Water Quality Control Board (Water Board). 1998. "Staff Report: Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments." May. The second bullet in Section B5.1.1 already contains the second reference and will be modified to include the first reference as follows. "San Francisco Bay ambient sediment data (Water Board 1998, <i>Eco Analysis 1998</i>) – EPCs for organic COPECs in sediment were..."

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2.	---	Food chain dose modeling is included as part of the SLERA. However, the dose modeling input parameters applied to the various receptors of concern (ROCs) are not consistent, nor is the approach presented the most conservative, as recommended by USEPA's Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, EPA 540-R-97-006, June 1997. This guidance indicates that input parameters for dose modeling equations should represent the most appropriate conservative measures, such as the highest ingestion rate, lowest body weight, most contaminated food item, and the maximum detected concentrations in environmental media, among others. Please revise the SLERA to include these parameters in the dose modeling equations.	<ul style="list-style-type: none"> • The most appropriate conservative exposure parameters were used in the SLERA as input parameters for dose modeling. • The maximum detected concentrations were used as the EPCs in the SLERA (Steps 1 and 2 of the ecological risk assessment process outlined in EPA guidance [1998b, 2001]). This assumes that receptors occur and feed exclusively at the location with the highest concentration; therefore, it is considered appropriately conservative for the SLERA. However, ecological receptors feed not only at the location with the maximum concentration but rather at multiple locations across the Parcel B shoreline. Therefore, in the refinement step of the BERA (Step 3a), the EPCs were revised from maximum concentrations to the 95 UCL to reflect more realistic exposure scenarios at the Parcel B shoreline, as recommended by both EPA (1998b, 2001) and Navy guidance (Navy 1999). • The highest ingestion rate and lowest body weight were not considered appropriate exposure parameters because the equation used to estimate the ingestion rate is based on the body weight of the receptor (Nagy 2001). Therefore, the highest ingestion rate does not correspond to the lowest body weight. To evaluate risk to populations of ecological receptors at the Parcel B shoreline, ingestion rates based on mean body weights were considered appropriately conservative because the assessment endpoint is maintenance of the population as a whole. Evaluation of risk to populations of receptors is consistent with EPA guidance. • No change to the report is proposed from this comment.
Specific Comments, Appendix B, Parcel B Screening-Level Ecological Risk Assessment of the Parcel B Shoreline, Sites IR-07 and IR-26			
1.	B-3	<u>Appendix B, Section B2.1, Conceptual Site Model, Page B-3:</u> The conceptual site model includes a discussion of stressors, fate and transport, exposure pathways, and assessment and measurement endpoints. No clear discussions of sources of contamination are included in the SLERA. Please revise the SLERA to include this information.	<ul style="list-style-type: none"> • The sources of contaminants are discussed in Section 2.3 (Updated Characterization of Soil and Groundwater) of the main TMSRA text and are not repeated in the SLERA because the SLERA was not intended to be a stand-alone document. • Section B2.1 on page B-3 will be revised as follows to direct the reader to Section 2.3 in the main TMSRA. "A conceptual site model for the Parcel B shoreline is presented on Figure B-3. <i>Sources of contamination are discussed in Section 2.3 (Updated Characterization of Soil and Groundwater) in the main TMSRA text. The following sections review...</i>"

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2.	B-7	<u>Appendix B, Section B2.2.1, Screening-Level and Refinement Evaluation for Sediment, Page B-7:</u> Sediment samples were taken from 0 to 2 ft bgs, and 2.5 to 4 ft bgs, but justification is not provided for these sampling depth intervals. Diving waterfowl and most benthic invertebrates could conceivably be expected to come into contact with the upper 6 inches of sediment, so it seems more reasonable to separate sediment depth intervals into a 0 to 0.5 ft bgs and 0.5 to 2 ft bgs depth intervals, with the inclusion of the 2.5 to 4 ft bgs depth interval to address potential exposure of sediment due to erosions processes, as explained in the SLERA. Please revise the SLERA to include a detailed technical discussion to support the selection of the presented depth intervals, or discuss this issue in the Uncertainties Section.	<ul style="list-style-type: none"> Selection of the depth intervals was evaluated and agreed during discussions with the regulatory agencies on the SLERA methodology. Section B5.2 will be expanded to include a discussion of uncertainties related to exposure to chemicals in the sediment intervals evaluated in the SLERA. The following text will be added to Section B5.2. <i>“Waterfowl and benthic invertebrates will be primarily exposed to the most surficial sediments. However, the shoreline at Parcel B is susceptible to erosional processes that could transport top sediments into the India Basin, exposing deeper sediments. Wind-driven waves and other disturbances of surface sediments could expose the deeper sediments, as well. The list of COPECs for benthic invertebrates is much the same for the surface and subsurface layers; there is no reason to expect that concentrations in the top 6 inches of sediment would differ greatly from the samples used in the SLERA.”</i>
3.	B-18	<u>Appendix B, Section B4.1.4, Chemical Concentrations in Sediment and Tissue Samples, Page B-18:</u> Based on information provided in the document, it appears that bioaccumulation factors (BAFs) calculated for terrestrial receptors at or near the site were used for investigating sediment media. This approach is inappropriate, due to the fact that location specific BAFs for terrestrial media are not representative of sediment media, in that location specific sediment chemical concentrations, sediment and water chemistry, and receptor specific uptake (among others) have not been taken into consideration. Please revise the SLERA to use media and site-specific derived sediment BAFs, or use appropriate literature derived sediment BAFs for investigating ecological exposures to contaminated sediments.	<ul style="list-style-type: none"> SLERAs, by definition, rely on information gathered from the literature, and rarely include much site-specific data beyond targeted abiotic samples. The Parcel B SLERA is more robust than is typical in that it benefits from extensive biological data collected on properties that are essentially identical in origin and natural environmental influence. The terrestrial and shoreline habitats of Parcels E and B are influenced both by the fill that was originally used to create the parcels, and by current interaction with the bay (which was also the original source of the underlying sediments). There is no reason to expect the physico-chemical parameters of the soil and sediment to differ substantially between Parcels E and B, and the Navy asserts that BAFs derived using data from Parcel E more closely approximate location-specific BAFs than do those taken from the literature that includes samples collected from around the world. No change to the report is proposed from this comment.

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4.	B-20	Appendix B, Section B4.2.1, Surf Scoter Dose Parameters, Sediment Ingestion Rate (IR_{sediment}), Page B-20: Information is provided in this section on sediment ingestion rates for the surf scoter. It is unclear, based on information provided in the document, how a value of 0.00273 kg/day derived as the sediment ingestion rate for the surf scoter. Please clarify how this value was derived.	<ul style="list-style-type: none"> The sediment ingestion rate for the surf scoter in the SLERA for the Parcel B shoreline was based on the sediment ingestion rate of the surf scoter in the Parcel F validation study. In the Parcel F validation study, the sediment ingestion rate was based on a field study which measured grit in the stomach contents of the closely related white-winged scoter (<i>Melanitta fusca deglandi</i>) at four locations in British Columbia (Vermeer and Bourne 1984). The sediment ingestion rate for the surf scoter in the Parcel F validation study was about 2.5 percent of the ingestion rate for prey. This sediment ingestion rate was conservatively rounded up to 3 percent of the prey ingestion rate (0.0909 kilogram per day) in the SLERA for the Parcel B shoreline. A sediment ingestion rate of 3 percent of the prey ingestion rate is similar to values estimated for diving ducks (Beyer and others 1994). The text describing the sediment ingestion rate on page B-20 will be revised as follows. "An incidental IR_{sediment} for the scoter of 0.00273 kg/day was used in the exposure model. <i>The sediment ingestion rate represents 3 percent of the prey ingestion rate (0.0909 kg/day) and is based on similar sediment ingestion rates for diving ducks (Beyer and others 1994).</i>"
5.	B-20	Appendix B, Section B4.2.1, Surf Scoter Dose Parameters, Sediment Ingestion Rate (IR_{sediment}), Page B-20: It is stated that literature derived BAFs are used where site-specific sediment BAFs are unavailable. This approach is entirely unclear, as site-specific BAFs appear to be available. Please clarify this methodology.	<ul style="list-style-type: none"> Site-specific BAFs were not available for all chemicals. Footnotes a, c, and g cite the references for the BAFs in Table B-9. Site-specific BAFs were unavailable and literature values were used for all chemicals footnoted with the letter "g" next to the values. Footnote g will be revised as follows to clearly explain that these BAFs are based on literature values. "g BAFs from EPA 1999 were used for these chemicals; <i>site-specific BAFs were not available for these chemicals.</i>"
Appendix C, Applicable or Relevant and Appropriate Requirements			
1.	---	The evaluation of each potential Federal and State ARAR in Appendix C of the TMSRA does not always include a discussion of the specific requirements and how the requirements will affect response actions planned for Parcel B. Also, the text of Appendix C does not always identify whether each regulation is considered "applicable" or "relevant and appropriate." Please review and revise Appendix C to consistently state in both the text and tables whether each regulation is "applicable" or "relevant and appropriate" and explain why each regulation is considered an ARAR.	<ul style="list-style-type: none"> The text and tables in Appendix C will be revised to identify whether each potential ARAR is applicable or relevant and appropriate and why each is an ARAR.

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2.	---	<u>Appendix C, Section C1.3, Other General Issues, General Approach to Requirements of the Federal Resource Conservation and Recovery Act.</u> The Federal Register citation is incorrect. The text cites to 63 Fed. Reg. § 49118 [2001] for the statement that California received final authorization of its revised State Hazardous Waste Management Program by the USEPA on September 26, 2001. The correct citation for this statement is 66 Fed. Reg. § 49118 [2001]. Please edit the citation accordingly.	<ul style="list-style-type: none"> The text of Section C1.3 will be corrected to indicate 66 Fed Reg. § 49118 [2001].
3.	C-9	<u>Appendix C, Section C1.4.1, RCRA Hazardous Waste Determination, Page C-9, 1st paragraph.</u> The text incorrectly cites Cal. Code Regs. Tit. 22, Div. 3, Chapter 15 for other state waste requirements. The correct citation is Cal. Code Regs. Tit. 23, Div. 3, Chapter 15. Please revise this section to cite the correct Cal. Code Regs. requirement.	<ul style="list-style-type: none"> The text of Section C1.4.1 will be corrected to indicate Cal. Code Regs. Tit. 23, Div. 3, Chapter 15.
4.	C-11	<u>Appendix C, Section C1.4.1, RCRA Hazardous Waste Determination, Page C-11, 4th full paragraph.</u> The text does not explain why the Navy believes that the contaminants found at the site are not ignitable, corrosive or reactive. The text states that, “[b]ased on the Navy’s knowledge of contamination at HPS Parcel B, the Navy has determined that the soil at HPS Parcel B is not ignitable, corrosive, or reactive, as defined in Cal. Code Regs. Tit. 22, § 66261.21-66261.23.” Please include a discussion of why the contaminants found at the site do not constitute ignitable, corrosive or reactive waste.	<ul style="list-style-type: none"> This statement is based on previous excavation and off-site disposal activities conducted under the ROD for Parcel B. The text of this paragraph will be revised as follows. “Based on the Navy’s knowledge of <i>soil</i> contamination at HPS Parcel B <i>gained from sampling and analysis of the soil for off-site disposal under the remedial action selected in the ROD dated October 1997, the Navy does not anticipate that excavated soil or waste generated in the performance of various alternatives presented in the TMSRA will meet the definition of ignitable, corrosive, or reactive hazardous waste</i>, as defined in Cal. Code Regs. Tit. 22 § 66261.21 – 66261.23.”
5.	C-12	<u>Appendix C, Section C1.4.3, Other California Waste Classifications, Page C-12, 1st paragraph.</u> The text incorrectly cites Cal. Code Regs. Tit. 22, §§ 20210, 20220 and 20230 as the state solid waste classification requirements that should be evaluated. The correct citation is to Cal. Code Regs. Tit. 27, §§ 20210, 20220 and 20230. Please revise this section to cite the correct Cal. Code Regs. requirement.	<ul style="list-style-type: none"> The text of Section C1.4.3 will be corrected to indicate Cal. Code Regs. Tit. 27, §§ 20210, 20220 and 20230.

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6.	C-12	<u>Appendix C, Section C1.4.3, Other California Waste Classifications, Page C-12.</u> This section does not discuss the requirement of Cal. Code Regs. Tit. 27 § 20230 even though the text identifies the requirement as a state solid waste classification requirement for evaluation. Please include a discussion of this requirement in this section and include the requirement in Table C-2, Page 5 where requirements 27 CCR § 20210 and § 20230 are identified.	<ul style="list-style-type: none"> Appendix C correctly identifies the definition of inert waste at Cal. Code Regs. Tit. 27, § 20230. There are no requirements prescribed by Cal. Code Regs Tit 27, § 20230. Cal. Code Regs. Tit. 27, 20230(b) states that inert waste does not need to be discharged at classified units. Cal. Code Regs. Tit. 27, 20230(c) allows the option of prescribing individual or general water discharge requirements for the discharge of inert waste. In addition, the State of California did not identify Cal. Code Regs. Tit. 27, § 20230 as a potential ARAR. The text of Section C1.4.3 will be revised as follows. “The Navy will characterize any waste it generates for off-site disposal according to <i>Cal. Code Regs. Tit. 27, §§ 20210 and 20220.</i>” Table C-2 will not be revised to add Cal. Code Regs. Tit. § 20230.
7.	---	<u>Appendix C, Section C2.1.3, ARARs Conclusions for Soil.</u> The requirements of 27 CCR § 20921 (a)(1) and (a)(2) are not discussed in this section. Please update section C2.1.3 to include this ARAR. Also, please update Table C-1 to include a discussion of this requirement. Please review Section 4 and Appendix C of the report to make sure that all of the Federal and State ARARs are identified in each section.	<ul style="list-style-type: none"> The same text provided as the discussion of Cal. Code Regs. Tit. 27, § 20921(a)(1) and (2) present in Section C2.2.3.2 will be added to Section C2.1.3. This regulation is considered a state chemical-specific ARAR and is already included on Table C-2. Table C-1 will not be revised. Section 4 and Appendix C will be reviewed for consistency.
8.	---	<u>Appendix C, Section C3.1.2, ARARs for Coastal Resources.</u> This section does not include a citation to all relevant sections of the Coastal Zone Management Act that may be ARARs. Please update Section C3.1.2 of the report to include a reference that §§ 1451 through 1464 of the Coastal Zone Management Act and 15 CFR § 930 are also ARARs for coastal resources.	<ul style="list-style-type: none"> The text of Section C3.1.2 will be revised as follows. The Navy has identified <i>the substantive provisions</i> of the following regulations as potential location-specific ARARs: <ul style="list-style-type: none"> Coastal Zone Management Act (16 U.S.C. § 1456c) and its accompanying implementing regulations in 15 CFR § 930 McAteer-Petris Act (California Government Code §§ 66600 through 66661) which is the enabling legislation for the San Francisco Bay Conservation and Development Commission and the San Francisco Bay Plan San Francisco Bay Plan (14 Cal. Code Regs. §§ 10110 through 11990)

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9.	---	<u>Appendix C, Section C4.0, Action-Specific ARARs, C4.1.2.2, State ARARS, Shoreline Revetment.</u> The requirements of Cal. Code Regs. Tit. 17 § 93105 are not discussed in this section. Please edit Section C4.0 to include a discussion of why this requirement is considered an applicable ARAR for construction of the shoreline revetment and covers for the soil. Also, please review sections 4.2 and Appendix C to ensure that all sections consistently identify all federal and state ARARs for Parcel B.	<ul style="list-style-type: none"> The discussions of action-specific ARARs in Section C4.0 are intended as summaries of the most significant requirements, except in those cases where the application of the requirement is complex and needs a more detailed explanation. Table C-6 contains a detailed explanation of the requirements contained in Cal. Code Regs. Tit. 17, § 93105. No change to the report is proposed from this comment.
10.	---	<u>Appendix C, Section C4.2.2.2, Potential Action-Specific ARARs for Groundwater Alternatives, State ARARs and Table C-6.</u> The requirements of 27 CCR § 20090(d) are not discussed in these sections. Please edit these two sections of the report to include a discussion regarding whether 27 CCR § 20090(d) is “applicable” or “relevant and appropriate” to groundwater monitoring actions that may be conducted at HPS Parcel B.	<ul style="list-style-type: none"> The State of California identified Cal. Code Regs. Tit. 27, § 20090(d) as a potential state ARAR for soil only; the state did not identify it as a potential state ARAR for groundwater. Therefore, the Navy identified Cal. Code Regs. Tit. 27, § 20090(d) as a potential state ARAR on Table C-6 for constructing the shoreline revetment and soil covers. In addition, the Navy has determined that, with the exception of Cal. Code Regs. Tit. 27, § 20430(g)(2), the potential state groundwater monitoring ARARs are not more stringent than the potential federal groundwater monitoring ARARs at Cal. Code Regs. Tit. 22. No change to the report is proposed from this comment.
11.	---	<u>Appendix C, Appendix C, Tables.</u> This section does not identify 22 CCR §§ 66268.40, 66268.48, 66268.49 and 66268.44 as potential ARARs even though these requirements are identified in Section C2.2.3.1 as potential federal ARARs for soil response actions. Please include a discussion of these requirements in the relevant table of Appendix C.	<ul style="list-style-type: none"> The Navy did not identify Cal. Code Regs. Tit. 22 §§ 66268.40, 66268.44, 66268.48, and 66268.49 as potential chemical-specific ARARs for Parcel B because the Navy does not anticipate having to treat the soil to meet these land disposal restriction (LDR) standards prior to off-site disposal. The off-site disposal facility will be responsible for ensuring any required compliance with RCRA LDRs. This discussion will be removed from the text in Section C2.2.3.1 and added to Table C-1 with an ARAR determination of “not applicable.” Temporary stockpiling requirements at 40 CFR § 264.554 (d)(1)(i) through (ii), (d)(2), (e), (f), (h), (i), (j), and (k) are included as action-specific ARARs for alternatives that include excavation (refer to Section C4.1.3.1 and Table C-5).

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12.	---	<u>Appendix C, Table C-1, Potential Federal Chemical-Specific Applicable or Relevant and Appropriate Requirements, Page 2 of 2, Toxic Substances Control Act. 40 CFR § 761.61(c)</u> may be an applicable ARAR rather than a relevant and appropriate ARAR since the Navy may have used and/or disposed of PCBs and PCB contamination exists at the site. Please either revise the Preliminary ARAR Determination field to identify this regulation as an applicable ARAR and revise the comments field to clearly state why the regulation is applicable or edit the comments field to state why the requirement is only relevant and appropriate to response actions planned at the site.	<ul style="list-style-type: none"> The Navy will include 40 CFR § 761.61(c) as an applicable requirement because the Toxic Substances Control Act (TSCA) regulates PCB remediation waste at as-found concentrations of greater than or equal to 50 parts per million (ppm) (40 CFR § 761.50(b)(3)). The Navy has measured a concentration of PCBs of 50 ppm in soil that remains in place (at IR-07) at Parcel B. The comment column will be revised to include the following. <i>“This requirement is applicable to soil contaminated with PCBs at levels greater than or equal to 50 ppm. A measured concentration of 50 mg/kg has been documented near the shoreline at IR-07.”</i>
13.	---	<u>Appendix C, Table C-2, Potential State Chemical-Specific Applicable or Relevant and Appropriate Requirements:</u> This section includes descriptions of requirements that are not ARARs. The purpose of the ARARs tables is to provide a simple overview of the requirements that are considered ARARs. Therefore, it is not necessary to include requirements that are not ARARs in the tables. Please review the tables and consider deleting the requirements that are not ARARs. If these requirements are removed from the tables, please consider identifying these requirements and the rationale for why they are not ARARs in the relevant text sections of the TMSRA.	<ul style="list-style-type: none"> The table is intended to summarize and document the analysis of ARARs, including requirements that are reviewed to evaluate whether or not they qualify as ARARs but are determined not to qualify. This presentation will support a more complete record of the Navy’s ARAR decision-making process. The entries in Table C-2 provide a quick synopsis in addition to the longer discussion already presented within the text of Appendix C. No change to the report is proposed from this comment.
14.	---	<u>Appendix C, Table C-3, Potential Federal Location-Specific Applicable or Relevant and Appropriate Requirements.</u> Section 404 of the Clean Water Act is likely an applicable ARAR rather than a relevant and appropriate ARAR. Section 404 of the Clean Water Act is identified as a relevant and appropriate ARAR for the construction of the shoreline revetment within a wetland area of the site. It is possible that this wetland meets the definition of a wetland in section 404 of the Clean Water Act and that the construction of the shoreline revetment will result in the filling of this wetland, which could be a violation of section 404. Please either revise the Preliminary ARAR Determination field to identify this regulation as an applicable ARAR and revise the comments field to clearly state why the regulation is applicable or edit the comments field to state why the requirement is only relevant and appropriate to the shoreline revetment response action.	<ul style="list-style-type: none"> The preliminary ARAR determination for Section 404 of the Clean Water Act will be changed from relevant and appropriate to applicable. The wetland is inundated by the bay during high tides; therefore, the Navy has concluded that the wetland is sufficiently connected to the bay to be considered regulated under the Clean Water Act, Section 404.

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15.	---	<u>Appendix C, Table C-4, Potential State Location-Specific Applicable or Relevant and Appropriate Requirements.</u> This table does not include a discussion of the all of the ARARs identified by the Navy in Section C3.1.2 of the TMSRA. Please revise this table to include a discussion of §§ 666000 through 66661 of the McAteer-Petris Act.	<ul style="list-style-type: none"> Table C-4 includes the substantive provisions of the McAteer-Petris Act and specific citations to Cal. Code Regs. Tit. 14 concerning the Bay Plan. The comments column will be expanded to state that the McAteer-Petris Act is the enabling legislation for the San Francisco Bay Conservation and Development Commission and the San Francisco Bay Plan (please also refer to the response to EPA specific comment 16 on Appendix C). The comment will be revised as follows. The San Francisco Bay Plan is an approved state coastal zone management program, and the Navy will continue to conduct its response actions in accordance with the goals of the San Francisco Bay Plan. <i>The McAteer-Petris Act is the enabling legislation for the San Francisco Bay Conservation and Development Commission and the San Francisco Bay Plan.</i> Table C-3 contains the discussion of the remaining ARARs presented in Section C3.1.2.
16.	---	<u>Appendix C, Table C-4, Potential State Location-Specific Applicable or Relevant and Appropriate Requirements, McAteer-Petris Act.</u> The San Francisco Bay Plan is likely an applicable ARAR rather than a relevant and appropriate ARAR. The Navy identifies the San Francisco Bay Plan at Cal. Code Regs. Tit. 14, §§ 10110 through 11990 as relevant and appropriate ARARs for response actions conducted with the San Francisco Bay coastal zone. In the comments field, the Navy states that the San Francisco Bay Plan is an approved state coastal zone management program. Please either revise the Preliminary ARAR Determination field to identify this regulation as an applicable ARAR and revise the comments field to clearly state why the regulation is applicable or edit the comments field to state why the requirement is only relevant and appropriate in spite of the federally approved status of the plan.	<ul style="list-style-type: none"> The San Francisco Bay Plan is a potential ARAR through the operation of the federal Coastal Zone Management Act (CZMA). First the Navy evaluated the ARAR status of the CZMA. The CZMA excludes federal lands from its definition of coastal zone. Parcel B is federal land; therefore, the CZMA is not applicable. The CZMA also requires that federal agency activity within the coastal zone (non-federal lands) that affects any land or water use or natural resource must be conducted in a manner consistent to the maximum extent practicable with approved state coastal zone management programs. The Navy's remedial alternatives for Parcel B will affect land adjacent to the bay; therefore, the Navy identified the CZMA as relevant and appropriate. Because the CZMA is relevant and appropriate, the McAteer-Petris Act as enabling legislation and the San Francisco Bay Plan, are potential relevant and appropriate requirements through operation of the CZMA. The comment column of Table C-4 will be revised as follows. <i>"The Navy has determined that the substantive provisions of the Coastal Zone Management Act are potential relevant and appropriate federal location-specific requirements for HPS Parcel B. The Coastal Zone Management Act requires federal agency activity be conducted in a manner consistent with approved state management programs to the maximum extent practicable. The McAteer-Petris Act is</i>

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			<i>enabling legislation for the San Francisco Bay Plan, an approved state management program for the San Francisco Bay. Substantive provisions of the McAtter-Petris Act and the San Francisco Bay Plan are relevant and appropriate because their authority is derived from the Coastal Zone Management Act, a relevant and appropriate federal requirement.</i>
17.	---	<u>Appendix C, Table C-5, Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements, Page 2 of 6.</u> The Navy did not indicate whether Cal. Code Regs. Tit. 22, § 66264.553(b), (d), (e), and (f) is “applicable” or “relevant and appropriate” or why this requirement is an ARAR for construction of a shoreline revetment. Please edit Table C-5 to include a Preliminary ARAR Determination and a rationale for why this requirement is an ARAR.	<ul style="list-style-type: none"> Table C-5 will be revised to indicate that the preliminary ARAR determination is <i>Applicable</i>. The comment column will be revised as follows: “<i>The requirements are applicable for soil that meets the definitions of RCRA hazardous waste or non-RCRA state regulated hazardous waste under Cal. Code Regs. tit. 22, including sediment with concentrations of PCBs greater than or equal to 5 mg/kg. Concentrations of PCBs greater than 5 mg/kg have been measured in sediment along the shoreline of IR-07.</i>” Follow-up: The concentrations in the above revision were corrected to 50 mg/kg (not 5 mg/kg).
18.	---	<u>Appendix C, Table C-5, Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements, Page 2 of 6, Clean Water Act.</u> Substantive requirements of the Clean Water Act are not indicated as “applicable” ARARs for the construction of the shoreline revetment. 33 U.S.C. § 1344, 40 CFR § 230.10 and 230.11 and 33 CFR part 323 are identified as applicable ARARs for construction of a shoreline revetment. In the comments field, the Navy indicates that they are not required to obtain a permit to discharge fill into a wetland at Parcel B but that they will comply with the permit requirements. Please edit the comments field to identify those substantive portions of the listed requirements which are the applicable ARARs for construction of a shoreline revetment.	<ul style="list-style-type: none"> Please refer to the response to EPA general comment 11.
19.	---	<u>Appendix C, Table C-5, Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements, Page 3 of 6.</u> 40 CFR § 264.554 (a), (d), (g), (h), (l), (j), and (k) should be identified as an applicable ARAR for soil which is determined to be RCRA hazardous waste. 40 CFR § 264.554(a), (d), (g), (h), (l), (j) and (k) are identified as relevant and appropriate ARARs for stockpiling soil for off-site disposal. The comments field indicates that it is not anticipated that all soil will be RCRA hazardous waste but that these requirements are considered relevant and appropriate for all stockpiled soil. Since some of the soil	<ul style="list-style-type: none"> The text of the comments column will be revised as follows. “The Navy will temporarily stockpile soil in staging piles for off-site disposal. The Navy will <i>characterize the soil</i> but does not anticipate that soil will be RCRA hazardous waste; <i>in which case, these requirements are relevant and appropriate. However, these requirements would be applicable to stockpiled soil that meets the definition of RCRA hazardous waste. Therefore, the Navy will identify these requirements as either applicable or relevant and appropriate, depending on the results of sampling and analysis for waste characterization.</i>”

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		may be RCRA hazardous waste, these requirements should be considered applicable ARARs for the stockpiling of soil for off-site disposal. Please revise the table to identify these requirements are applicable ARARs to soil determined to be RCRA hazardous waste.	<ul style="list-style-type: none"> The preliminary ARAR determination will remain relevant and appropriate.
20.	---	<u>Appendix C, Table C-5, Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements.</u> This table does not include a discussion of 40 CFR § 761.61 even though it is identified as an action-specific ARAR in Section C2.2.3.1. Please edit this table to include a discussion of this requirement.	<ul style="list-style-type: none"> The TSCA requirement of 40 CFR § 761.61(c) is identified as a potential federal chemical-specific ARAR in Section C2.2.3.1 and on Table C-1. Section C4.0, not C2.2.3.1, presents potential action-specific ARARs. The Navy did not identify 40 CFR § 761.61(c) as a potential federal action-specific ARAR. No change to the report is proposed from this comment.
Appendix D, Remedial Action Alternative Cost Summary Sheets			
1.	---	Costs for the Finding of Suitability to Transfer (FOST) should not be included in the alternative costs because a FOST is not part of a remedy. Please delete all FOST costs from the cost estimates.	<ul style="list-style-type: none"> Navy costs for preparing the FOST are included in the cost tables in Appendix D because this document is part of the overall process leading to transfer of Parcel B.
2.	---	The wetlands mitigation necessary to restore wetlands that will be destroyed when the shoreline revetment is built is not included in the cost estimates for Alternatives S-2, S-3, S-4, and S-5. Please include wetlands mitigation costs in the cost estimates for Alternatives S-2, S-3, S-4, and S-5.	<ul style="list-style-type: none"> The cost estimates for Alternatives S-2 through S-5 will be updated to include a line item for wetland mitigation costs. The area to be mitigated is a fraction of an acre (1,300 ft² or 0.03 acre) and the estimated cost (\$100,000) is a rough estimate.
General Comments, Appendix E, Beneficial Use Evaluation for Parcel B Groundwater			
1.	---	The beneficial use evaluation in Appendix E has not adequately addressed USEPA's recommendations for evaluating groundwater using the document, Guideline for Ground-Water Classification Under the EPA Groundwater Protection Strategy, dated December 1986 (the guidance document). Attachment 5 of USEPA's letter to the BRAC Business Line Coordinator dated June 30, 1998, provided specific recommendations for determining whether a contaminated aquifer or portion of an aquifer should be considered a potential drinking water source for the purpose of making CERCLA cleanup decisions. These recommendations have been applied to groundwater at Parcel B only; however, as described in chapter 3 of the guidance document, the groundwater classification process was developed for evaluation of groundwater within a Classification Review Area (CRA), which extends beyond the boundaries of the site where	<ul style="list-style-type: none"> Subdivision of the aquifer system at HPS to include the A- and B-aquifers separated by the Bay Mud confining layer has been accepted by the regulatory agencies at least since the RI. Furthermore, the Water Board acknowledged the aquifer subdivisions in its 2003 letter exempting the groundwater in the A-aquifer as a potential source of drinking water. The beneficial use evaluation at HPS is site specific and presented parcel by parcel. The Navy acknowledges that gaps in the Bay Mud exist in limited areas. The third paragraph of Section 2.2.4.1 in the main TMSRA text notes that "Bay Mud Deposits act as an aquitard that separates the A- and B-aquifers over most of the parcel, except for part of the western portion at IR-18 and some of the central portion in IR-10, where the Bay Mud is absent and the A- and B-aquifers are

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		<p>groundwater is to be classified. In addition, USEPA has requested that consideration of potential health threats that may result from unanticipated or even prohibited uses of groundwater be included; however, only the B-Aquifer has been evaluated for these uses. As a result, the Navy's evaluation of groundwater at Parcel B contains several discrepancies which include, but are not limited to those identified below. These issues are presented here for the purpose of identifying groundwater classification criteria that were not adequately addressed in the evaluation presented in Appendix E. These issues should not be addressed as individual discrepancies, but as part of the groundwater classification procedure outlined by the guidance document.</p> <p>Parcel B groundwater was subdivided into groundwater units without demonstrating that the A, B and Bedrock Aquifers are separated by subdivision boundaries. Groundwater units are defined in Section 3.4.2 of the guidance document, as bodies of groundwater that are determined on the basis of four types of boundaries, including: 1) Permanent groundwater flow divides; 2) Extensive, low permeability geologic units (e.g., thick, laterally extensive confining beds); 3) Permanent fresh-water/saline-water contacts; and 4) Hydraulic gradient-based boundaries that separate permanent upgradient from permanent downgradient parts of a shallow groundwater unit. For the purpose of this evaluation, the A and B Aquifers would not be considered separate groundwater units based on the presence of a Type 2 boundary, since the Bay Mud unit is not extensive within the CRA. In addition, the guidance requires that the existence of one or more of these boundaries be demonstrated for all foreseeable conditions before the groundwater regime of CRA can be subdivided into separate groundwater units. Foreseeable conditions that may effect the presence of these boundaries should include, but should not be limited to, removal of leaking water supply, sanitary sewer and storm drain lines; repair or removal of segments of the sea wall barriers, unless they will be maintained as an institutional control; and installation of groundwater extraction wells or groundwater production wells. Please revise the Beneficial Use Evaluation to follow the groundwater classification procedure outlined by the guidance document.</p>	<p>adjacent.”</p> <ul style="list-style-type: none"> • The boundary between the A- and B-aquifers (the Bay Mud), while not present everywhere, does provide separation between the aquifers for the majority of Parcel B. Strict interpretation of the groundwater classification guidance and recombination of the aquifer system at Parcel B into one unit would pose a significant obstacle for progress toward cleanup. The existing ROD prohibits all uses of groundwater to 90 feet bgs and use of groundwater will be prohibited under the amended ROD. • Foreseeable conditions are not anticipated to change the aquifer boundaries. Changes to the water supply system or removal of the sanitary sewer and storm drain systems are not expected to cause large changes in the aquifer system at Parcel B. The seawall at Parcel B does not act as a hydrogeologic barrier within the aquifer system and does not affect the aquifer boundaries; saline groundwater extends about 500 feet inland from the shoreline, regardless of the presence of a seawall. Installation of groundwater extraction or production wells will be prohibited and this prohibition maintained by institutional controls. • The following text will be added to Section E1.0 to more fully describe the aquifer classification at Parcel B. <p><i>“The hydrostratigraphic units at HPS include (1) the A-aquifer, (2) the aquitard, (3) the B-aquifer, and (4) the deep bedrock water-bearing zone. The A-aquifer at Parcel B consists mainly of unconsolidated Artificial Fill that overlies the aquitard and bedrock and forms a continuous zone of unconfined groundwater across the parcel. Alluvium and colluvium. Undifferentiated Upper Sand Deposits, and shallow bedrock also are part of the A-aquifer at various locations across Parcel B. The A-aquifer generally thickens from about 15 feet in the southwest to as much as 80 feet in the northeast, but averages about 25 feet thick over most of Parcel B.</i></p> <p><i>The B-aquifer consists mainly of Undifferentiated Sedimentary Deposits that overlie bedrock or are contained within the Bay Mud Deposits at a few locations near the bay margin. The B-aquifer is not continuous across Parcel B but exists primarily in two separate areas—along the western parcel boundary, and in a portion of the central area of the parcel. The B-aquifer ranges in thickness from about 5 to 15 feet where it is present and averages 10 feet thick.</i></p>

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			<p>[Follow-up: The Navy believes that the 10-foot thickness cited for the B-aquifer is consistent with the interpretation presented on Figure 5 of “Final Technical Memorandum, Distribution of the Bay Mud Aquitard and Characterization of the B-Aquifer in Parcel B” (Tetra Tech 2001).]</p> <p><i>Bay Mud Deposits act as an aquitard that separates the A- and B-aquifers over most of the parcel, except for part of the western portion at IR-18 and some of the central portion in IR-10, where the Bay Mud is absent and the A- and B-aquifers are adjacent. The Bay Mud Deposits generally thicken from where they pinch out against the historical shoreline in the southwest to 40 feet near the bay margin in the northeast.</i></p> <p><i>The boundary between the A- and B-aquifers (the Bay Mud), while not present everywhere, does provide separation between the aquifers for the majority of Parcel B. The Navy and the regulatory agencies have agreed to use this classification of the aquifer system at Parcel B and the beneficial use evaluation presented in this appendix maintains this classification system, even though the classification may vary from the strict definitions presented in EPA guidance on groundwater beneficial use (EPA 1986).”</i></p>
2.	---	<p>An evaluation of the impact of A-Aquifer groundwater on the quality of adjacent waters, including the B-Aquifer and surface waters (i.e., wetlands and the San Francisco Bay), was not adequately addressed in Appendix E, because a low degree of interconnection between the A-Aquifer and adjacent waters has not been demonstrated. As described in Section 3.4.2 of the guidance document, a high degree of interconnection is assumed to occur where groundwater discharges to surface waters, when a lower degree of interconnection is not demonstrated. Furthermore, according to Section 4.1.1 of the guidance document, a Class I determination may be reached if groundwater that is highly vulnerable to contamination discharges to areas that are managed for the purpose of ecological protection. Section E2.2.3.8 of the TMSRA has already identified Parcel B groundwater as being highly vulnerable to contamination. Therefore, for the purpose of this evaluation, the presence of wetland habitats within the CRA that are currently, or will be, managed for the purpose of ecological protection should be identified. Discharge areas that may affect the wetland areas should then be located to determine whether the classification criteria for Class I groundwater</p>	<ul style="list-style-type: none"> The degree to which the A-aquifer discharges to the bay is not well quantified at Parcel B. The Navy recognizes the potential impact to the bay from mercury in IR-26 groundwater. No other IR site contaminants are located near enough to the bay or at a high enough concentration to be considered a potential threat to the bay. The Navy disagrees that groundwater in the A-aquifer qualifies as Class I groundwater for the following reasons. <ul style="list-style-type: none"> (1) The groundwater in the A-aquifer is not “ecologically vital groundwater” as Class I groundwater is described in the guidance. Groundwater does not supply a “sensitive ecological system supporting a unique habitat” at Parcel B. The guidance indicates “A unique habitat is primarily defined as a habitat for a listed or proposed endangered or threatened species.” No listed or proposed endangered or threatened species exist at Parcel B in upland areas or along the shoreline; therefore, the A-aquifer groundwater cannot be considered ecologically vital. The contribution of groundwater to the recharge of the bay is insignificant compared to other sources including rivers, creeks, and tidal interchange with the Pacific Ocean.

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		<p>applies to Parcel B. If a Class I or Class II determination cannot be made for groundwater, a Subclass IIIA determination should be evaluated based on the interconnectedness of groundwater with surface water. Subclass IIIA groundwaters are defined in Section 2.1.3 of the guidance document, as having an intermediate degree of interconnection to adjacent groundwater units and/or are interconnected with surface water, and as a result, they may be contributing to the degradation of the adjacent waters. The guidance document further states in Section 2.1.3 that, "Subclass IIIA groundwater may still be managed at a level similar to a level at which Class II groundwaters are managed based on the degree to which it is connected to adjacent waters." Please revise the beneficial use evaluation to consider a high degree of interconnection between groundwater and surface water.</p>	<p>(2) The definition of Class I groundwater also includes a designation as an irreplaceable source of drinking water to a substantial population. No public water systems using groundwater or private supply wells are known within 2 miles from HPS. A substantial population (2,500 people according to the guidance) is not served by groundwater on or near HPS.</p> <p>(3) In general, the guidance describes Class I groundwater as "It is expected that Class I decisions will be small in number. Such ground waters will generally receive extraordinary protection due to the potential risk to large numbers of citizens dependent upon a source of drinking water..." No one depends on groundwater at or near HPS. A Class I determination is not supported by the existing knowledge of the aquifers at HPS.</p> <ul style="list-style-type: none"> • The Navy has accounted for potential interconnection between groundwater and surface water. The results from the SLERA indicated only mercury in groundwater was a concern for a limited section of the shoreline at Parcel B. The plans for groundwater remediation proposed in the TMSRA will be protective of San Francisco Bay surface waters. • The following text will be added to the end of Section E2.2.1 on page E-4. <i>"Groundwater in the A-aquifer does not qualify as Class I for the following reasons:</i> <ol style="list-style-type: none"> (1) <i>Groundwater in the A-aquifer is not "ecologically vital groundwater" nor does it supply a "sensitive ecological system supporting a unique habitat" at Parcel B. No listed or proposed endangered or threatened species exist at Parcel B in upland areas or along the shoreline; therefore, the A-aquifer groundwater cannot be considered ecologically vital.</i> (2) <i>Groundwater in the A-aquifer is not an irreplaceable source of drinking water to a substantial population. No public water systems using groundwater or private supply wells are known within 2 miles from HPS. A substantial population (2,500 people according to EPA guidance) is not served by groundwater on or near HPS.</i> (3) <i>In general, the guidance describes Class I groundwater as "It is expected that Class I decisions will be small in number. Such ground waters will generally receive extraordinary protection due to the potential risk to large numbers of citizens dependent upon a source of drinking water..." No one</i>

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			<i>depends on groundwater at or near HPS. A Class I determination is not supported by the existing knowledge of the aquifers at HPS."</i>
3.	---	Consideration of unanticipated and currently prohibited uses of groundwater was limited to the B-Aquifer; however, the A-Aquifer should also be included in this scenario, since areas of the A-aquifer are favorable for the installation of private drinking water wells. For example, according to Section E2.2.3.1 of the TMSRA, the A-Aquifer in Parcel B contains approximately 220 acre feet of available groundwater. Based on this assessment, a determination should be made as to whether A-Aquifer groundwater would represent an irreplaceable source to a substantial population should San Francisco's water supply be disrupted in the event of another catastrophic earthquake. This scenario is based on the concept that metropolitan areas potentially face greater health risks should the current water supply system be destroyed. Guidelines for determining whether groundwater represents an irreplaceable source to a substantial population are provided in Section 4.2 of the guidance document. Special consideration should be given to the "Unreliable Transport Mechanism" decision criteria for transportation of a replacement water supply, because A-Aquifer groundwater would be readily available in a time of crisis, thus making it less replaceable. Please revise the beneficial use evaluation to consider use of A-Aquifer groundwater in the case of a catastrophic earthquake.	<ul style="list-style-type: none"> The Navy does not believe that groundwater in the A-aquifer would become an irreplaceable source in the event of a catastrophic earthquake for the following reasons. <ol style="list-style-type: none"> (1) Groundwater in the A-aquifer is only marginally better salinity than the EPA criterion of 10,000 milligrams per liter. Groundwater salinity would increase based on any degree of pumping for domestic use. (2) Assuming necessary equipment and personnel were available, there are much more favorable locations along the San Francisco peninsula than Parcel B to develop water resources—especially areas farther from the bay that are less subject to salt water intrusion in response to groundwater withdrawal. (3) According to Mr. Greg Bartow, Integrated Water Resources Program Manager for the San Francisco Public Utilities Commission, Office of Water Resources Planning, the City of San Francisco has no plans in the foreseeable future to use HPS groundwater for an emergency city water supply. No change to the report is proposed from this comment.
Specific Comments, Appendix E, Beneficial Use Evaluation for Parcel B Groundwater			
1.	E-1	Appendix E, Section E2.0, Evaluation of Groundwater Beneficial Uses, <u>Page E-1</u> : It should not be assumed that B-Aquifer groundwater will not be used for agricultural or industrial uses based solely on the redevelopment plan; potential use of this water after a catastrophic earthquake should also be considered. Please revise the beneficial use evaluation to consider use of B-Aquifer groundwater in the case of a catastrophic earthquake.	<ul style="list-style-type: none"> Please refer to the response to EPA general comment 3 on Appendix E. Furthermore, only two groundwater monitoring wells are currently installed in the B-aquifer at Parcel B. Groundwater extraction from these wells, even assuming appropriate pumping equipment and trained personnel were available, would not be adequate to support more than a few individuals. No change to the report is proposed from this comment. Follow-up: The Navy continues to believe that there will be no beneficial use of the B-aquifer groundwater after an earthquake, regardless of the number of wells installed based on the following: (1) the volume of groundwater available is small, (2) any groundwater withdrawal will likely result in the intrusion of salt water which would further degrade the aquifer, and (3) city staff have indicated no intention to use groundwater in the B-aquifer for emergency supply.

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2.	E-3	<u>Appendix E, Section E2.1.1, Federal Groundwater Classification Criteria, Page E-3:</u> Class II groundwater is separated into two subclasses, IIA and IIB, but this was not considered in the beneficial use evaluation. Please distinguish between subclass IIA and subclass IIB groundwater and provide definitions for each in this section.	<ul style="list-style-type: none"> The text of Section E2.2.1 will be revised as follows. "Class II groundwater is a current source (<i>Class IIA</i>) or potential source (<i>Class IIB</i>) of drinking water ..."
3.	E-7	<u>Appendix E, Historical and Current Groundwater Use, Page E-7:</u> The text does not state that the Basin Plan for the San Francisco Bay Region has not been amended. Please revise this section to state that the Basin Plan had not been amended at the time the TMSRA was issued.	<ul style="list-style-type: none"> The text of Section E2.2.3.7 will be revised as follows. "This information on the nearby Downtown San Francisco Basin...source of drinking water. <i>However, although the Water Board had adopted this amendment in April 2000, the State Water Resources Control Board and Office of Administrative Law had not yet approved this amendment to the Basin Plan at the time the TMSRA was prepared.</i>"
4.	---	<u>Appendix E, Table E-1, Summary of Total Dissolved Solids in Parcel B Groundwater:</u> It is not clear why the number of Total Dissolved Solids (TDS) measurements exceeds the number of wells sampled in this table. For example, according to the table, the concentration of TDS was measured in 71 wells; however, 168 measurements were used in the data set. Please identify the methodology for the data set used in the evaluation of TDS concentrations at Parcel B.	<ul style="list-style-type: none"> The number of measurements exceeds the number of wells because, in some cases, multiple measurements were made over time from a single well. The data set includes all TDS data from all A-aquifer wells at Parcel B. A footnote to Table E-1 will be added to state "<i>The number of measurements exceeds the number of wells because more than one measurement was made at some wells. The data set for this table includes all TDS data from all A-aquifer wells at Parcel B.</i>"
5.	---	<u>Appendix E, Figure E-1, Maximum Total Dissolved Solids in the A-Aquifer:</u> It appears that the purple shaded area should extend into the vicinity of Buildings 122 and portions of Building 123, based on the total dissolved solids (TDS) values posted on this figure. Please revise the boundary between the purple shaded area and the yellow shaded area to encompass all of the areas with TDS values below 3000 mg/L.	<ul style="list-style-type: none"> Figure E-1 will be revised so that the 3,000 mg/L contour includes additional area in the vicinity of Buildings 122 and 123.
Minor Comments			
1.	A-6	<u>Appendix A, Section A3.5: Potentially Complete Exposure Pathways, Page A-6:</u> This section lists the components of a complete exposure pathway as presented in USEPA's RAGS, Part A (1989). However, the presence of a receptor population is also a required component of a complete exposure pathway. Revision to address this oversight is not a required action.	<ul style="list-style-type: none"> Section A3.5 will be revised to clarify that the presence of a receptor population is also required as an element for establishing a complete exposure pathway.

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2.	---	<u>Appendix C, Section C2.1.1, ARARs Conclusions for Groundwater, 4th bullet.</u> There is an extra space between the “n” and the “s” in the word “provisions.” Please edit this sentence to correct this typographical error.	<ul style="list-style-type: none"> The text will be revised as suggested.
3.	C-31	<u>Appendix C, Section C4.1.2.1, Federal ARARs, Shoreline Revetment, Page C-31.</u> There is a typographical error in the last paragraph on Page C-31. In the last paragraph, the text states that the Navy has identified the Bay Area Air Quality Management District Regulation 6-302 “is” a potential federal action-specific ARAR. Please edit this sentence to change the typographical error “is” to “as.”	<ul style="list-style-type: none"> The text will be revised as suggested.
4.	D-19	<u>Appendix D, Section D6.7, Cost Assumptions Associated with Alternative GW-3B: In Situ Treatment, Reduced Groundwater Monitoring, and Institutional Controls-SVI Injection, Page D-19:</u> The first sentence in item #10 compares GW-3B to GW3-B when it appears that GW-3A was intended. Please correct this sentence.	<ul style="list-style-type: none"> The text will be revised as suggested.

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The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the “Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated March 28, 2006. Comments were submitted by Thomas P. Lanphar (DTSC) on June 19, 2006; specific comment 63 was revised on July 18, 2006. Additional comments were submitted by Mr. Lanphar on September 1, 2006. Throughout this table, *italicized* text represents proposed additions to the TMSRA and ~~strikeout~~ text indicates locations of proposed deletions. These responses were submitted on December 8, 2006 and discussed with DTSC during meetings on January 9 and 23, 2007. Additional information related to a response as a result of further discussions is identified in this table as “**Follow-up**” at the end of a response. Throughout this table, references to page, section, table, and figure numbers pertain to the draft TMSRA, even though some of these numbers have changed in the draft final TMSRA.

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General Comments			
1.	---	DTSC does not agree that ambient metals are naturally occurring. DTSC’s position is that remedial action goals for soil should be established based on total risk and not incremental risk. DTSC can accept ‘agree to disagree’ language on this issue as long as the final remedy for soil is protective of total risk (i.e., ambient metals in soil).	<ul style="list-style-type: none"> Total risk includes risk posed by all chemicals, including ubiquitous metals. The incremental risk addresses chemicals related to Navy activities; the Navy does not consider ubiquitous metals to be the result of Navy activity, but instead the result of the natural distribution of metals in the bedrock formations that make up Hunters Point. Remediation alternatives in the TMSRA are focused on cleaning up those chemicals related to Navy activities. Therefore, the TMSRA uses the incremental risk evaluation as the basis for alternative identification. However, remedial alternatives in the TMSRA are designed to also be protective of risks from ubiquitous metals, regardless of source. Therefore, the remedy for soil will be protective of total risk. Follow-up: The following clarification of the term “ubiquitous” was added to the executive summary, Section 1.2 (need for reevaluation of current remedy) and Section 2.3 (updated characterization of soil and groundwater). “In the TMSRA, the term “ubiquitous” refers to metals that are naturally occurring or are in the same concentration ranges as naturally occurring metals in the source material (including material from the same geologic formations in the San Francisco area) used for filling operations at HPS. The Navy acknowledges that industrial sources of metals exist at HPS and there is a potential that some concentrations of metals could have sources other than naturally occurring materials. The Navy has worked to remove these sources during the remedial actions taken to date.”

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2.	---	<p>The Navy acknowledges that the fill is contaminated with ‘ubiquitous’ metals; however, this must be more clearly defined in the document and the implications of this contamination carried out consistently in the establishment of remedial action objectives and soil alternatives. DTSC agrees that contamination, above ambient levels, is likely to occur in all parts of Parcel B. The fill at Parcel B is not fully characterized and therefore areas with little or no soil data are assumed to be contaminated with chemicals of concern above ambient levels. DTSC supports a soil alternative that includes containment and institutional controls for all redevelopment blocks and the entire shoreline of Parcel B.</p>	<ul style="list-style-type: none"> • The Navy believes that the practice of using of quarried local rock for fill at HPS is similar to construction practices in the same bedrock formations used elsewhere in San Francisco. The Navy observed that a wide range of concentrations of metals are found in similar chert, basalt, and serpentinite bedrock formations in other areas of San Francisco based on sampling that the Navy conducted in 2003 at areas outside of HPS (Tetra Tech and ITSI 2004). • The text proposed for addition to the executive summary and new Section 1.2 (see EPA general comment 1) will help clarify this position (see Attachment 1). In addition, the text in Section 2.3.1 (partial paragraph at the top of page 2-18) will be modified to include the following. “The same condition is true for a group of metals...and zinc. <i>The Navy acknowledges that industrial sources for metals exist and that there is a potential that some concentrations of metals could have sources other than naturally occurring rock. The Navy has worked to remove these sources during the remedial actions taken to date. However, the widespread distribution of metals remaining in soil is consistent with the concentrations present in native rock. Remedial alternatives in this TMSRA will be designed to be protective of risks from these metals concentrations, regardless of source.</i> Section 3.0 and...” • Remedial alternatives in the TMSRA are designed to also be protective of risks from ubiquitous metals, regardless of source. Alternatives S-4 and S-5 include containment (using covers and a shoreline revetment) and institutional controls for all redevelopment blocks at Parcel B.
3.	---	<p>The Navy proposes to eliminate most of the groundwater monitoring requirements of the current ROD. Groundwater alternatives in the TMSRA only address volatile organic compounds (VOCs) and mercury. DTSC does not agree with the removal of other metals from groundwater monitoring. While DTSC is open to negotiating changes in the groundwater monitoring program, DTSC requests that monitoring for metals along the shoreline continue and is expanded to include additional monitoring points at IR-20 and IR-26.</p>	<ul style="list-style-type: none"> • Proposed constituents for groundwater monitoring are based on risk posed by groundwater to human health and the environment. • Changes to the current RAMP sampling will not be implemented until after the approval of the amended ROD for Parcel B. • DTSC’s proposed additions to the RAMP for IR-20 and IR-26 are not related to the TMSRA and should be addressed separately in another forum. The TMSRA is not intended to be a mechanism to modify the current RAMP sampling. • No change to the report is proposed from this comment.

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			<ul style="list-style-type: none"> • Follow-up: Concerns for groundwater in this area were focused on the results for a grab groundwater sample collected in 1993 from boring IR20B016 and for groundwater samples collected in 1994 from wells IR20MW06A and IR20MW17A. Results for grab groundwater samples were not included in the HHRA; however, the location of boring IR20B016 was excavated as Excavation 20-3 in 1998 to 1999. Soils were removed to 5 feet bgs; groundwater is about 6.5 feet bgs in this area. The samples in question from wells IR20MW06A and IR20MW17A were included in the HHRA as well as other data from these wells and eight other crossgradient and downgradient wells. No unacceptable risks were identified in this area in the HHRA and, consequently, no wells in this area were proposed for monitoring. However, the Navy is implementing a adaptable strategy for groundwater monitoring based on the Triad approach to allow flexibility to optimize monitoring. This strategy may be included in the future design of the groundwater monitoring program, and, if implemented, could change to the proposed monitoring wells and analytes presented in the TMSRA.
4.	---	<p>Mercury is known to occur in groundwater near the shoreline and soil at 10 feet below the surface. Passive remediation of mercury in groundwater is proposed. DTSC disagrees that passive remediation is appropriate for mercury in groundwater since mercury is not destroyed through natural processes. DTSC believes the source of the mercury in groundwater is still present at IR-26 and requests the removal of the mercury source prior to monitoring groundwater to determine if the bay surface water is protected.</p>	<ul style="list-style-type: none"> • The TMSRA evaluates excavating and removing additional soil beneath Excavation EE-05 to remove potentially remaining mercury source material. The Navy has installed two new groundwater monitoring wells in the area near well IR26MW47A where mercury was detected in groundwater. A third well will be installed within the area of Excavation EE-05 after selection of the final remedy and completion of the mercury source removal. • The size of the soil/water partition coefficients for the likely mercury species present in soil and groundwater at the site indicates a preference for sorption to soil. Thus, with removal of the source materials through excavation, it is likely that remaining mercury species dissolved in groundwater would attenuate through sorption into soil over time. • Please also refer to the responses to EPA specific comments 59 and 61 and DTSC (Lanphar) specific comment 58. • Follow-up: The clean fill used to backfill the excavation that will deepen Excavation EE-05 will act as a sink for mercury dissolved in groundwater based on the high sorptive capacity of the clean material.

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Specific Comments			
1.	ES-1	Page ES-1, Purpose and Background of TMSRA. One of the reasons for amending the Parcel B Record of Decision (ROD) and what provided a better understanding of the nature of soil contamination at Parcel B was the difficulty in meeting soil remediation goals during the post-Parcel B ROD soil excavations. That experience has led to the new site conceptual model recognizing that the Parcel B fill is not well characterized and is likely contaminated throughout the parcel with metals above ambient levels. Please modify this section to reflect this history. The TMSRA does acknowledge this issue in Section 2.1.3.1.	<ul style="list-style-type: none"> Please refer to the responses to EPA general comments 1 and 5 and DTSC (Lanphar) specific comment 17.
2.	ES-1	Page ES-1, Purpose and Background of TMSRA. Please revise the document and define what is meant by 'the ubiquitous nature of certain chemicals in soil'. DTSC understands this statement to refer to chemical contaminants in fill that are above ambient levels and potentially occur in soil throughout Parcel B; even in those areas that are not well characterized.	<ul style="list-style-type: none"> Please refer to the response to EPA general comment 1. In the TMSRA, the term ubiquitous refers to metals that are naturally occurring or have no known industrial source and are in the same concentration ranges as naturally occurring metals in the same geologic formations in the San Francisco area. Other contaminants, such as polynuclear aromatic hydrocarbons (PAH), may occur at multiple site locations but are not considered ubiquitous. Follow-up: The following clarification of the term "ubiquitous" was added to the executive summary, Section 1.2 (need for reevaluation of current remedy) and Section 2.3 (updated characterization of soil and groundwater). "In the TMSRA, the term "ubiquitous" refers to metals that are naturally occurring or are in the same concentration ranges as naturally occurring metals in the source material (including material from the same geologic formations in the San Francisco area) used for filling operations at HPS. The Navy acknowledges that industrial sources of metals exist at HPS and there is a potential that some concentrations of metals could have sources other than naturally occurring materials. The Navy has worked to remove these sources during the remedial actions taken to date."

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3.	ES-3	<u>Page ES-2, Hunters Point Shipyard Background.</u> The text states that after World War II activities at Hunters Point Shifted to submarine maintenance and repair. Were the activities limited to only this? What other ship maintenance occurred at Hunters Point after World War II? The decontamination of Operation Crossroads ships occurred after World War II. Also, please add a sentence or two about the activities of the Naval Radiological Defense Laboratory.	<ul style="list-style-type: none"> The executive summary in the first paragraph on page ES-2 will be revised to include the following text. "After World War II, activities at Hunters Point Shipyard shifted to submarine maintenance and repair. <i>However, the Navy continued to operate carrier overhaul and ship maintenance and repair facilities through the 1960s. Other significant activities after World War II included decontamination of ships used during Operation Crossroads nuclear weapons tests; these activities occurred mainly in 1946 and 1947.</i> Hunters Point Shipyard was also the site of the Naval Radiological Defense Laboratory from the late 1940s until 1969. Initial tasks for the laboratory included research into decontamination methods, personnel protection, and development of radiation detection instrumentation. Laboratory responsibilities grew to also include practical and applied research into the effects of radiation on living organisms and on natural and synthetic materials, in addition to continued decontamination experimentation. Hunters Point Shipyard was deactivated..."
4.	ES-3	<u>Page ES-3, Parcel B History and Setting.</u> Please add that sources of fill included construction debris and other waste materials.	<ul style="list-style-type: none"> The executive summary in the first paragraph on page ES-3 will be revised to include the following text. "...constructed by placing borrowed fill material from a variety of sources, including serpentinite bedrock from the shipyard, <i>construction debris, and waste materials (such as used sandblast materials).</i> The fill supported..."
5.	ES-3	<u>Page ES-3, Parcel B History and Setting.</u> In the first paragraph of Page ES-3 it states, "No threatened or endangered species are known to inhabit Hunters Point Shipyard or its vicinity." Please check the accuracy of this statement. For example peregrine falcons are known to hunt and perhaps nest on Hunters Point Shipyard. The statement also implies that animal species are not a concern at Hunters Point Shipyard. Additional statements about other ecological concerns, for example burrowing owls and migratory birds, would provide a better description of the ecological concerns that the Navy is responding to at Hunters Point Shipyard.	<ul style="list-style-type: none"> Please see the response to EPA specific comment 2. Although the Parcel B FS reported that "a peregrine falcon has been observed at HPS" there is no indication of routine use of Parcel B for foraging or nesting activities. It would be incorrect to assume animal species are not a concern at Parcel B; the SLERA evaluates potential exposures to several animal receptors, including a variety of birds and mammals. The red-tailed hawk was selected to represent carnivorous birds. Burrowing owls have not been observed at Parcel B. The executive summary in the first paragraph on page ES-3 will be revised to include the following text. "Therefore, the Navy investigated the shoreline areas, and this TMSRA evaluates potential risk to shoreline receptors, <i>including benthic invertebrates, birds, and mammals.</i>"

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6.	ES-5	<p><u>Page ES-5, Updated Risk Evaluation Summary.</u> When discussing total and incremental risk exposure areas please include a discussion of the limitations of this assessment due to the ubiquitous nature of certain chemical contaminants, or chemicals of concern (COCs) in soil (see ES-1). Please state that the conclusion of the risk assessment is limited and that areas of Parcel B with little or no data are also assumed to be contaminated with non-ambient ubiquitous chemical contaminants. Therefore, these areas also present an unacceptable incremental risk. Please identify which chemicals what chemical contaminants and the approximate concentration range the Navy believes are ubiquitous.</p>	<ul style="list-style-type: none"> While ubiquitous metals may pose unacceptable risk in areas that are currently not represented by sample data, it would be incorrect to assume this is always the case. Nevertheless, the Navy proposes to address all areas at Parcel B in the alternatives, although risk has not been quantified as occurring above background levels in all redevelopment blocks. The remedies will be protective of potential exposure to ubiquitous metals that may pose unacceptable risk. Covers to eliminate the exposure pathway will be an important component of the remedy. Ubiquitous metals at HPS include aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. Calculations of Hunters Point ambient levels for most of these metals is detailed in "Draft Calculation of Hunters Point Ambient Levels" (PRC 1995). In addition, the Navy will provide the results of off-site soil sampling for metals in Appendix J. Please refer to these two sources for concentration ranges of metals at HPS (within the geologic unit known as the Hunters Point Shear Zone). The use of soil covers will be further clarified in the second paragraph of Section 5.1 by expanding the text as follows. "...eliminate complete exposure pathways. <i>Soil covers will eliminate exposure to potential unacceptable risk identified by the HHRA, and to potential unacceptable risk posed by ubiquitous metals that are likely to be present in locations that are not characterized by analytical data. Covers will use existing materials (rehabilitated as necessary) and newly installed materials to eliminate exposure. Various institutional controls...</i>"
7.	ES-5	<p><u>Page ES-5, TMSRA Evaluation Process.</u> Please include a short description of the site conceptual model that explains and supports the conclusion that incremental soil risk is elevated due to the presence of certain non-ambient ubiquitous chemical contaminants. Important concepts to convey are 1) fill sources include construction and other waste debris; 2) the difficulty meeting soil remediation goals during the post Record of Decision soil remedial actions; and 3) data is limited in some areas and therefore not well characterized.</p>	<ul style="list-style-type: none"> The executive summary will be expanded to include a brief section titled "Updated Characterization of Soil and Groundwater" and will summarize information contained in Section 2.3. The following text will be added following the section titled "Parcel B Remedial and Regulatory Activities since the 1997 Record of Decision." <i>"The Navy's knowledge of the distribution of inorganic chemicals in native soil and artificial fill has increased greatly as a result of the extensive excavations and sampling at Parcel B since 1998. In particular, the ubiquitous nature of metals in fill is much clearer now than during the initial design of the remedial action and is a large part of the reason for the reevaluation presented in this TMSRA. The characterization of chemicals in groundwater at Parcel B has increased greatly since the 1997 ROD. The implementation of the remedial action monitoring program in 1999 and the subsequent, continuous quarterly</i>

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			<p><i>monitoring have increased the knowledge of the distribution of chemicals in groundwater.”</i> The text added earlier in the executive summary will also serve to further explain sources of fill (see response to DTSC [Lanphar] specific comment 4) and the difficulty in meeting ROD soil cleanup goals (see responses to EPA general comments 1 and 5). Please see the response to DTSC (Lanphar) specific comment 6 for discussion of data limitations.</p> <ul style="list-style-type: none"> • Follow-up: A new section was not created in the executive summary; however, the information requested was added to the section titled “Parcel B Remedial and Regulatory Activities since the 1997 Record of Decision.”
8.	ES-5	<p><u>Page ES-5, TMSRA Evaluation Process.</u> The text states that ambient metals are considered by the Navy to be naturally occurring. DTSC does not agree with the Navy on this point. DTSC position is that the fill is contaminated with metals released to the environment during the construction of the shipyard. DTSC can accept ‘agree to disagree’ language on this matter, if the final soil remedy protects public health and the environment from the “total” risk posed by metals in the fill.</p>	<ul style="list-style-type: none"> • Please refer to the response to EPA general comment 5 and DTSC (Lanphar) specific comment 6. The Navy proposes to cover all areas at Parcel B and these covers will be protective of potential exposure to ubiquitous metals that may pose unacceptable risk.
9.	ES-7	<p><u>Page ES-7 Identify Remedial Alternatives.</u> Specific comments on Remedial Alternatives are provided in DTSC’s comments on Section 5.</p>	<ul style="list-style-type: none"> • Please see the responses to DTSC (Lanphar) specific comments 61 through 64.
10.	ES-9	<p><u>Page ES-9 Evaluation Results for Soil and Groundwater Alternatives.</u> Specific comments on Remedial Alternatives are provided in DTSC’s comments on Section 5.</p>	<ul style="list-style-type: none"> • Please see the responses to DTSC (Lanphar) specific comments 61 through 64.
11.	1-2	<p><u>Page 1-2, Section 1.3 Purpose and Organization of Report.</u> Please list the elements of the Parcel B Feasibility Study that require updating.</p>	<ul style="list-style-type: none"> • The text of the first paragraph of Section 1.3 will be revised as follows. “...only those elements requiring updates to support or reflect the proposed amendments to the ROD are provided. <i>For example, updates are included for the HHRA, the SLERA, and the soil and groundwater characterization, but updates are not necessary for topics where there have been no changes since the ROD (such as climate and topography).</i>”

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12.	1-3	<u>Page 1-3, Section 1.3 Purpose and Organization of Report, first bullet.</u> Please change the word ‘elements’ to ‘chemical contaminants’ or chemicals of concern (COCs). This change will help differentiate between ambient metals and the certain contaminants that are uniformly distributed and are expected to occur in areas that have not been characterized or lack data.	<ul style="list-style-type: none"> The text of the first bullet on page 1-3 will be modified to replace “elements” with “metals.” The term “chemical of concern” applies to any compound, organic or inorganic, and would not be correct in the context of the sentence in question. The intent of the sentence was to describe metals. Furthermore, the term COC also implies a chemical-specific excess lifetime cancer risk greater than 10^{-6} or a noncancer risk (hazard index) greater than 1. The statement was not intended to imply any risk level.
13.	2-5	<u>Page 2-5, Section 2.1.3.2 History of Groundwater Actions.</u> Please include a discussion of the Technical Memorandum Parcel B Groundwater Evaluation, Draft November 30, 2001. Please include in this discussion the objective of the evaluation, conclusions of the evaluation and how this study is or is not used in developing Chemicals of Concern and remedial objectives.	<ul style="list-style-type: none"> The cited report does not provide any new data, but only summarizes and interprets data that were available at that time. An updated interpretation of groundwater conditions is included in the TMSRA and a review of previous interpretations is not necessary for selection of remediation alternatives. The cited report is not used in the TMSRA for development of COCs or remediation objectives. No change to the report is proposed from this comment. Follow-up: A paragraph was added to Section 2.1.3.2 to describe the objectives and conclusions from the groundwater evaluation technical memorandum.
14.	2-5	<u>Page 2-5, Section 2.1.3.2 History of Groundwater Actions.</u> Please discuss the study to determine whether the RU-C5 contaminant plume had migrated across the B/C parcel boundary.	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 16.
15.	2-12	<u>Page 2.12, Section 2.1.5.4 First Five-Year Review, Recommendation and Follow-up Actions for Groundwater, Second Bullet.</u> The document states that the TMSRA does not contain specific recommendations for trigger levels and that specific detail would be contained in the remedial design following the ROD amendment. Please distinguish between what the Navy defines as a trigger level and a remediation goal. Tables 3-18 and 3-19 do list remediation goals for groundwater in the A and B aquifers.	<ul style="list-style-type: none"> In the cited discussion of the five-year review, the term “trigger level” refers to the remedial action monitoring program (RAMP), not to any remediation goal proposed in the TMSRA. RAMP trigger levels are the comparison criteria against which groundwater data are compared. The TMSRA identifies remediation goals for groundwater in conjunction with the results of the risk assessments to target areas in groundwater that may require remediation. Appendix I will be added to the TMSRA to discuss trigger levels for groundwater to address potential migration to surface water (similar to the discussion provided for the Parcel D FS). The text of the second bullet on page 2-12 will be revised as follows. “Trigger levels should be reevaluated. <i>Appendix I of the TMSRA contains recommendations for revised trigger levels.</i>”

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16.	2-12	Page 2-12, Section 2.1.5.4 First Five-Year Review, Recommendation and Follow-up Actions for Groundwater, Sixth Bullet. The five-year review recommended the installation of a point of compliance well and characterization wells at IR-07. These wells are not included in TMSRA proposal for continued groundwater monitoring.	<ul style="list-style-type: none"> As stated in the text of the sixth bullet, five wells (IR07MWS-4, IR07MW21A1, IR07MW24A, IR07MW25A, and IR07MW26A) were reinstalled at IR-07, as recommended in the five-year review. The TMSRA used data collected from these reinstalled wells for the risk assessments, which did not show risk associated with groundwater in this part of Parcel B. Therefore, the TMSRA did not propose additional groundwater monitoring at these wells. No change to the report is proposed from this comment.
17.	2-13	<p>Page 2-13, Section 2.2 Updated Conceptual Site Model. A primary objective of the conceptual site model is to convey the source, location, and pathways of contamination. The conceptual site model in this section, or in Appendix A, does not meet this objective. Through earlier investigations and remedial actions at Parcel B we now understand the ubiquitous nature of certain chemical contaminants in soil. These ubiquitous chemicals contaminants should not be confused with ambient metals. Therefore a new conceptual site model requires development. Please develop a new conceptual site model for Section 2.2 and Appendix A that includes the following elements.</p> <ol style="list-style-type: none"> 1. Soil removals at Parcel B were often unable to meet Remedial Action Objectives, thus indicating the incomplete characterization of contaminated soil sites. 2. The sources and condition of fill used to construct Hunters Point Shipyard is not known. Earlier soil removal actions have indicated that the fill is contaminated with construction and other waste debris. Without extensive fill characterization the assumption is that the fill is generally contaminated with ubiquitous chemical contaminants. 3. The soil risk assessment relies on an incomplete data set. Therefore Redevelopment Blocks with limited or 	<ul style="list-style-type: none"> In the TMSRA, the term ubiquitous refers to metals that are naturally occurring, or have no known industrial source and are in the same concentration ranges as naturally occurring metals in the same geologic formations in San Francisco area. Follow-up: The following clarification of the term “ubiquitous” was added to the executive summary, Section 1.2 (need for reevaluation of current remedy) and Section 2.3 (updated characterization of soil and groundwater). “In the TMSRA, the term “ubiquitous” refers to metals that are naturally occurring or are in the same concentration ranges as naturally occurring metals in the source material (including material from the same geologic formations in the San Francisco area) used for filling operations at HPS. The Navy acknowledges that industrial sources of metals exist at HPS and there is a potential that some concentrations of metals could have sources other than naturally occurring materials. The Navy has worked to remove these sources during the remedial actions taken to date.” (1) and (2) Please refer to the responses to DTSC (Lanphar) specific comments 6 and 7. The text of Section 2.3 will be revised as follows to further explain changes to the conceptual site model. <p>“The nature of contaminants at Parcel B can mostly be attributed to industrial activities by the Navy or other tenants, except for several <i>ubiquitous</i> metals present throughout Parcel B at ambient concentrations. The position that discrete releases of chemicals (the “spill” model) were the sources for contamination that was the basis for the ROD and remedial actions was not valid everywhere at Parcel B. Nevertheless, the Navy did successfully achieve the ROD remediation goals at the majority of excavations conducted during the remedial actions. However, based on the knowledge gained during the remedial actions, the conceptual site model needs to be supplemented to account for the ubiquitous nature of</p>

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		<p>no data can not be assumed to be free of risk, but are instead assumed to pose an unacceptable risk.</p> <p>4. The fill at Hunters Point also contains ambient metals at concentrations that present an unacceptable total risk. The source of the ambient metals is the native serpentine bedrock and soil found at Hunters Point. The source of the ubiquitous chemical contaminants is the mingling of construction and other waste debris with other fill sources.</p>	<p><i>metals contained in the fill used to construct many areas of Parcel B and to address the use of debris as fill at IR-07/18. The spill model for chemical releases does not apply to the debris fill at IR-07/18 or for other areas where quarried native rock was used as fill. The remedial alternatives proposed in the TMSRA address these changes to the conceptual site model."</i></p> <ul style="list-style-type: none"> • (2) The Navy has records documenting the placement of contaminated fill at several areas, including IR Sites 1, 2, 7, and 18. Aerial photographs show the placement of fill derived from the highlands. While there is some uncertainty regarding the mixing of clean and contaminated fill, it would not be correct to assume that the fill is generally contaminated with ubiquitous chemical contaminants. <p>The Navy strongly disagrees that chemical contamination is ubiquitous at Parcel B. The term ubiquitous implies that there is contamination everywhere and that is not the case. Soil removals at Parcel B were unsuccessful at IR-07 and IR-18 because the fill material was contaminated before it was placed and placement of the fill resulted in a heterogeneous mixture of clean and contaminated fill. In addition, HPALs were adopted as cleanup goals for metals. Because of the statistical method used to calculate HPALs, a percentage of soil samples are expected to exceed the goals even when the soil is clean.</p> <ul style="list-style-type: none"> • (3) The Navy believes that the soil risk assessment data set is sufficient to evaluate the remediation alternatives described in the TMSRA. Redevelopment blocks with no data exist because there is no reason to expect a spill or release, and therefore, no reason to collect data. • (3) and (4) Please refer to the response to DTSC (Lanphar) specific comment 6 and EPA general comment 5. While ubiquitous metals likely pose unacceptable risk in areas that are currently not represented by sample data, it would be incorrect to assume this is always the case. Nevertheless, the Navy proposes to address all areas at Parcel B in the alternatives, although risk has not been quantified as occurring above background levels in all redevelopment blocks. The remedies will be protective of potential exposure to ubiquitous metals that may pose unacceptable risk.

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18.	2-16	<u>Page 2-16, Section 2.2.4.2 Groundwater Flow Patterns.</u> Groundwater flow patterns were created using data collected in November 2004. Please update the draft final using more recent data. Also please discuss changes in groundwater flow due to the shutting off of the sanitary sewer system. Please identify the date that the sanitary sewer system was shutdown in Parcel B.	<ul style="list-style-type: none"> Concerning groundwater flow patterns, please refer to the response to EPA specific comment 4. The sanitary sewers were shut off on May 1, 2007. After this date, the sewers were no longer operable. Quarterly monitoring scheduled after the shut down, will likely show changes in groundwater flow. Subsequent groundwater monitoring reports will address any observed changes in groundwater flow.
19.	2-17	<u>Page 2-17, Section 2.2.4.3 Beneficial Use of Groundwater, B-Aquifer.</u> The text states that the groundwater ingestion pathway for Parcel B is included in the human health risk assessment because of agreements with the BCT. Explaining the rationale for the inclusion of Parcel B groundwater in the human health risk assessment would be more illuminating. Please explain in the text that because the B aquifer is legally considered a potential source of drinking water, the human health risk assessment must evaluate the risk of ingestion of B aquifer groundwater. If the ingestion of B aquifer groundwater does pose a health risk remedial action will be necessary. This action will likely be in the form of an institutional control that prohibits the human consumption of B aquifer groundwater.	<ul style="list-style-type: none"> The text of Section 2.2.4.3 on the top of page 2-17 will be modified as follows. "However, the groundwater ingestion pathway is included in the human health risk assessment for the B-aquifer groundwater because of agreements with the BCT on the methodology for the human health risk assessment (see Section 3.0 and Appendix A), <i>and because the groundwater in the B-aquifer has not been exempted from the potential municipal and domestic beneficial uses specified in the Water Quality Control Plan for the San Francisco Bay Region</i>" This revision also applies to similar text in Section 3.1.1 (first paragraph on page 3-3) and Appendix A (first paragraph on page A-8). Institutional controls for groundwater are discussed in Section 4.3.2.1.
20.	2-17	<u>Page 2-17, Section 2.3 Updated Characterization of Soil and Groundwater.</u> Please provide a caveat in this section that references the new conceptual site model and the contaminated nature of the fill. The current text does not support this new model. For example, the text states, "The nature of contaminants at Parcel B can mostly be attributed to industrial activities by the Navy or other tenants, except for several metals present throughout Parcel B at ambient concentrations." This statement does not acknowledge the disposal activities that were also	<ul style="list-style-type: none"> Please refer to the responses to DTSC (Lanphar) specific comments 6, 12, and 17. Changes to the text of Section 2.3 will be as discussed in the response to DTSC (Lanphar) specific comment 17.

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		apart of the construction of the fill at Hunters Point. Also, please identify the chemicals of concern that are believed to be ubiquitous in nature. Please identify the expected concentration range of these chemicals.	
21.	2-18	Page 2-18, Section 2.3.1 Overview of Soil. When discussing soil characterization in Parcel B and the shoreline please discuss the limitations of the soil remedial actions (i.e. the inability to meet soil cleanup goals) and difficulties in collecting soil and sediment samples along the shoreline (i.e. planned sample collection locations were not sampled because of the presence of rip rap).	<ul style="list-style-type: none"> • Please refer to the responses to DTSC (Lanphar) specific comments 6 and 17 concerning limitations of remedial actions. • Details concerning difficulties in collecting sediment samples along the shoreline were previously discussed in Section 2.1.2 and do not need to be repeated. No change to the report is proposed from this comment.
22.	2-18	Page 2-18, Section 2.3.2 Overview of Groundwater. Please clearly state which quarterly groundwater monitoring data is being used to determine the extent of plumes. The November 2004 quarterly data seems to be the most recent groundwater data used when discussing groundwater contamination in the text and the figures. However, 2005 data is used when describing mercury in groundwater at IR-26.	<ul style="list-style-type: none"> • The following text will be added to the end of the first paragraph of Section 2.3.2. <i>“The groundwater data used in this TMSRA include samples collected through November 2004. Narrative descriptions of groundwater data in the text of the TMSRA have been updated to account for samples collected through May 2006. However, data sets (for example, those used for the HHRA and SLERA) have not been updated. The Navy has reviewed the results of samples collected after November 2004 and has found no reason to expect that the new data would change the groundwater characterization discussed here.”</i>
23.	2-18	Page 2-18, Section 2.3.2 Overview of Groundwater and Table 2-3 RAMP Wells and Exceedences. a. Please refer to and describe Table 2-3 in the text. b. Please update the table to include the most recent groundwater monitoring data. c. Please identify the dates of the quarterly groundwater monitoring events.	<ul style="list-style-type: none"> • (a) Section 2.1.3.2 introduces and discusses Table 2-3. No change to the report is proposed from this comment. • (b) Table 2-3 will be updated to include data collected through May 2006 (quarter 26). • (c) Table 2-3 will be modified to include the dates of the monitoring events.

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		<p>d. Please identify on the table for each quarter the chemical analytes with detection limits that exceed the RAMP criteria. For example, analytes with detection limits above the RAMP criteria could be shown with a colored font (e.g. Zn).</p> <p>e. Please discuss any issues that would affect the quality of groundwater data, including detection limits above screening criteria and issues with groundwater sample collection.</p>	<ul style="list-style-type: none"> (d) Table 2-3 is intended only to provide an overview of the results of the RAMP, not an in-depth analysis. Information concerning analytical detection limits for each sample, for each monitoring event is available in the individual quarterly monitoring reports. A table showing practical quantitation limits that exceed the RAMP comparison criteria (if any) will be added to the Parcel B quarterly groundwater monitoring reports beginning in the third quarter of 2006. The risk assessments in the TMSRA consider detection limits and nondetected results. No change to the table is proposed from this comment. (e) Please refer to the response to previous comment (d). The following text will be added to Section 2.1.3.2 in the first paragraph on page 2-6 in the discussion of the RAMP. "Table 2-3 identifies chemicals that exceeded RAMP criteria, ...<i>Table 2-3 is intended to provide an overview of the results of the RAMP; please refer to the individual quarterly reports for details such as detection limits and specific issues that might affect groundwater data quality for any individual sampling event.</i>"
24.	2-18	<p><u>Page 2-18, Section 2.3.2 Overview of Groundwater – Mercury plume at IR-26.</u></p> <p>a. Please include a figure of IR-26 showing the locations of the monitoring wells, the area and depth of the excavation and the locations and concentration of mercury in soil. Also indicate the location of the conduit/tunnel coming from the adjacent dry dock, and the depth to groundwater (below ground surface).</p> <p>b. The available data for mercury in soil and groundwater is not sufficient to characterize the site and make conclusions as to whether mercury is not impacting the San Francisco Bay. Mercury was detected in bottom (approximately ten feet below ground surface and possibly in groundwater) composite samples at a concentration of as much as 90 mg/kg. Mercury at this concentration indicates the continued presence of mercury source for groundwater contamination. The conclusion stated in the last paragraph of page 2-19 only further indicate that the Navy does not understand</p>	<ul style="list-style-type: none"> (a) Figure 2-12 will be added to illustrate the location of Excavation EE-05, the surrounding groundwater monitoring wells, and the location of structures, including the drainage tunnel. The approximate depth to groundwater in this area will be labeled on the figure. Please refer to Figure EE-05C of the Construction Summary Report for details of the confirmation samples collected for mercury. (b) The Navy has installed two new groundwater monitoring wells in the area near well IR26MW47A. A third well will be installed within the area of Excavation EE-05 after selection of the final remedy and completion of the mercury source removal. Please refer to the response to EPA specific comment 59. (c) The text of Section 2.3.2 describes the distribution of soil and groundwater samples analyzed for mercury at IR-26 and the uncertainties created by the complex geochemistry of mercury in groundwater. The addition of three groundwater monitoring wells in this area will further reduce the uncertainties related to the mercury distribution in groundwater at IR-26. No change to the text is proposed from this comment. (d) The ROD established the soil cleanup goal for mercury at 2.3 mg/kg to be protective of human health. This concentration is the HPAL for mercury. Mercury concentrations in sediment at IR-26 were less than the HPAL so the SLERA did not calculate a sediment cleanup goal. Therefore, it cannot be determined whether the HPAL is protective of

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		<p>the nature and extent or the fate and transport of mercury in groundwater at IR-26.</p> <p>c. Please critically analyze and describe the limitations of mercury data at IR-26.</p> <p>d. Please explain the basis of the 2.3 mg/kg cleanup goal for mercury. Is this concentration considered protective of surface water?</p>	<p>surface water. However, the Navy does not excavate any metal in soil to a concentration below its HPAL.</p>
25.	---	<p><u>Section 2 Figures.</u> Please include a figure that shows the location of wells with RAMP exceedances, including exceedances of the detection limits. Please include on this figure a spider diagram showing the chemical and concentration (or detection limit if detection limit exceeded RAMP criteria).</p>	<ul style="list-style-type: none"> The discussion in Section 2.1.3.2 is intended only to provide an overview of the results of the RAMP in sufficient detail to support the evaluation of alternatives, not to provide an in-depth analysis. Information concerning analytical detection limits for each sample, for each monitoring event is available in the individual quarterly monitoring reports. A table showing practical quantitation limits that exceed the RAMP comparison criteria (if any) will be added to the Parcel B quarterly groundwater monitoring reports beginning in the third quarter of 2006. The risk assessments in the TMSRA consider detection limits and nondetected results. No change to the report is proposed from this comment.
26	3-2	<p><u>Page 3-2, Section 3.1.3 Exposure Scenarios and Pathways.</u> Mercury is a volatile metal. Please evaluate the human health risk of mercury in subsurface soil and groundwater through the inhalation pathway as part of the TMSRA.</p>	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 21 regarding the planned evaluation of vapor inhalation exposure to mercury in groundwater in the TMSRA. Minimal partitioning of mercury in soil from a nonvolatile phase to a gaseous phase is expected, as mercury in soil tends to complex with anions and form mercury compounds with limited mobility and volatility. For this reason, inhalation from volatilization of mercury in soil to ambient air is not evaluated in the TMSRA. Inhalation of mercury compounds released to ambient air in particulate form (from wind erosion) is also not evaluated in the TMSRA because toxicity criteria are not available for the evaluation of mercury compounds in the form of airborne particulates. Please also refer to the response to DTSC (Lanphar) specific comment 58. As stated in the groundwater HHRA methodology documents developed for HPS, risks from vapor intrusion of volatile chemicals in the unsaturated zone will not be quantitatively assessed in the HHRA because soil gas data for HPS are not of sufficient quality for HHRA. The uncertainty analysis presented in Appendix A will be revised to address this limitation. It should be noted that concentrations of volatile chemicals in groundwater alone result in elevated vapor intrusion risks across Parcel B and engineering

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			<p>or occupancy controls are, therefore, proposed for indoor air.</p> <ul style="list-style-type: none"> • Follow-up: The Navy and the regulatory agencies continue to discuss vapor intrusion issues; consequently, no changes were made to the uncertainty analysis in Appendix A.
27.	3-2	<p><u>Page 3-2, Section 3.1.3 Exposure Scenarios and Pathways.</u> The example for an indirect exposure pathway (inhalation) is incorrect. Inhalation is a direct exposure pathway. Eating produce that is contaminated from chemical uptake or fish that has concentrations of bio-accumulated chemicals are examples of indirect exposure pathways.</p>	<ul style="list-style-type: none"> • The text of Section 3.1.1 on page 3-2 will be revised as follows. “Both direct exposure pathways (for example, ingestion) and indirect exposure pathways (for example, <i>inhalation ingestion of home-grown produce</i>) were identified...”
28.	3-3	<p><u>Page 3-3, Section 3.1.1 Exposure Scenarios and Pathways.</u> The text states that the groundwater ingestion pathway for Parcel B is included in the human health risk assessment because of agreements with the BCT. Explaining the rationale for the inclusion of Parcel B groundwater in the human health risk assessment would be more illuminating. Please explain in the text that because the B aquifer is legally considered a potential source of drinking water, the human health risk assessment must evaluate the risk of ingestion of B aquifer groundwater. If the ingestion of B aquifer groundwater does pose a health risk remedial action will be necessary. This action will likely be in the form of and institutional control that prohibits the human consumption of B aquifer groundwater.</p>	<ul style="list-style-type: none"> • Please refer to the response to DTSC (Lanphar) specific comment 19.
29.	3-3	<p><u>Page 3-3, Section 3.1.1 Exposure Scenarios and Pathways.</u> Risk plumes were developed using data collected at Parcel B through November 2004. As DTSC comments on the quarterly reports have indicated, issues with sample collection, detection limits, and removed and replaced wells raise concerns with the quality of the groundwater data. Improvements to the groundwater monitoring program were undertaken by the Navy after November</p>	<ul style="list-style-type: none"> • Please refer to the response to EPA specific comment 4. The risk assessments and databases included in the TMSRA will not be updated for samples collected after November 2004.

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		2004. Some replace Point of Compliance Wells and Post Remedial Action wells have very few quarterly monitoring events as of November 2004. Please update these risk plumes in the draft final using the most recent laboratory certified data.	
30.	3-4	<u>Page 3-4, Section 3.1.1 Exposure Scenarios and Pathways; top paragraph.</u> Please explain further in the text how groundwater risk from “non-plume exposure areas” will be evaluated using the exposure area grids established for soil.	<ul style="list-style-type: none"> The text of Section 3.1.1 at the bottom of page 3-3 will be revised as follows. “Chemical concentrations measured from some groundwater monitoring locations at Parcel B were not associated with risk plumes; these <i>nonplume-based locations were evaluated on a grid-basis, using the same grid system that was used in the HHRA to evaluate soil exposures as an efficient mechanism to locate each nonplume risk evaluation.</i>”
31.	3-4	<u>Page 3-4, Section 3.1.1 Exposure Scenarios and Pathways.</u> Please refer to the appropriate figure in Appendix A when discussing soil risk and groundwater risk plumes.	<ul style="list-style-type: none"> The text of Section 3.1.1 in the last paragraph on page 3-3 will be revised as follows. “The risk plumes were developed using a specific methodology...(see Attachment A4, <i>Figures A4-1 through A4-3</i>).” Remaining figures are referenced in Sections 3.1.3 and 3.1.4 that discuss the soil and groundwater risk results.
32.	3-4	<u>Page 3-4, Section 3.1.2 Total and Incremental Risks for Exposure to Soil.</u> Please include, in the text, a caveat stating that the total and incremental risk calculations and figures are based on available data and that some sites and redevelopment blocks have limited (not fully characterized) or no data. Please further state in the text that because of the ubiquitous nature of some chemical contaminants the risk in areas with limited or no data can not be determined and are assumed to present unacceptable risk.	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 6. The Navy believes that the risk assessment data set is sufficient to evaluate the remediation alternatives for soil that are presented in the TMSRA, and that chemical contamination is not ubiquitous across Parcel B. No change to the report is proposed from this comment.
33.	3-4	<u>Page 3-4, Section 3.1.2 Total and Incremental Risks for Exposure to Soil.</u> Please identify the chemicals contaminants (non-ambient) that are believed to be ubiquitous and concentrations for these contaminants so that risk can be calculated and communicated.	<ul style="list-style-type: none"> The Navy disagrees that there is ubiquitous chemical contamination across Parcel B. Please refer to the response to DTSC (Lanphar) specific comment 6. No change to the report is proposed from this comment.

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34.	3-4	<u>Page 3-4, Section 3.1.2 Total and Incremental Risks for Exposure to Soil; Requested Figure.</u> Please include figures that show total and incremental risk by redevelopment block. Redevelopment blocks with limited or no data should also show unacceptable risk due to the ubiquitous nature of some chemical contaminants.	<ul style="list-style-type: none"> Figures 3-2 and 3-3 show total risk based on planned reuse by redevelopment block. Figures 3-5 and 3-6 show incremental risk based on planned reuse by redevelopment block. No new figures or figure revisions are proposed to be added as a result of this comment. Please refer to the response to DTSC (Lanphar) specific comment 6 regarding redevelopment blocks with limited or no data.
35.	3-5	<u>Page 3-5, Section 3.1.3.1 Total Risk Evaluation.</u> Please include a note at the foot of the table explaining why surface soil risk is not applicable for the industrial or construction worker.	<ul style="list-style-type: none"> Surface soil exposures were evaluated for the industrial worker scenario (see Appendix A of the TMSRA). Footnote 1 of the table will be modified as follows. "Chemicals of concern identified for this exposure scenario are based on the planned reuse of Parcel B. <i>No chemicals of concern were identified for the exposure of industrial workers to surface soil.</i>" Based on discussions and an agreement with the BCT in March 2004, evaluation of construction worker exposure to soil in the HHRA was limited to subsurface soil (0 to 10 feet bgs). This depth range includes sample results from surface soil samples. Footnote 2 will be revised as follows. "The construction worker exposure scenario is not associated with a specific planned reuse for Parcel B. <i>Based on discussions and an agreement with the BCT, evaluation of construction worker exposure to soil was based on subsurface soil from 0 to 10 feet bgs; this depth range includes surface soil (0 to 2 feet bgs) exposure.</i>"
36.	3-6	<u>Page 3-6, Section 3.1.3.2 Incremental Risk Evaluation.</u> Please include in the text the caveat that the calculated risk is based on collected data and that Redevelopment Blocks, which are not fully characterized or lack data, are also assumed to present an unacceptable risk.	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 6.
37.	3-6	<u>Page 3-6, Section 3.1.4 Risk Summary for Groundwater.</u> Please include the mercury plume at IR-26. Presently, mercury is consistently detected in only one monitoring well; however, the groundwater in this area is not adequately characterized.	<ul style="list-style-type: none"> Mercury has been detected in groundwater at IR-26 only at well IR26MW47A as of May 2006 (CE2-Kleinfelder 2006c). New information from newly installed wells IR26MW49A and IR26MW50A will be presented in quarterly groundwater monitoring reports for Parcel B. Narrative descriptions of groundwater data in the TMSRA will be updated to account for samples collected through May 2006.

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38.	3-6	<u>Page 3-6, Section 3.1.4 Risk Summary for Groundwater.</u> Please identify and discuss groundwater monitoring data where the detection limits have exceeded the human health and ecological screening levels.	<ul style="list-style-type: none"> The uncertainty analysis presented in Appendix A (HHRA) will be revised to include a qualitative discussion regarding the potential for risks and hazards to be underestimated as a result of elevated detection limits for some chemicals. No changes are proposed for Section 3.1.4.
39.	3-9	<u>Page 3-9, Section 3.2 Ecological Evaluation.</u> Please identify the dates and quarters of the "12 most recent sampling events". Please update this data with the most recent laboratory certified groundwater data.	<ul style="list-style-type: none"> The 12 most recent sampling events used for groundwater data in the risk assessments vary by well and by analyte; there is no single date range that would adequately characterize the groundwater data set. The use of the 12 most recent sampling events was the agreed upon methodology. Section A4.1 on page A-8 of Appendix A describes the groundwater data set. No change to the report is proposed from this comment. Please refer to the response to EPA specific comment 4 concerning updating the groundwater data set.
40.	3-9	<u>Page 3-9, Section 3.2 Ecological Evaluation.</u> Only mercury is identified as a Chemical of Concern for ecological receptors for the groundwater to bay water pathway. Table B-8: "Hazard Quotients for Invertebrate Receptors Based on the Ratio of the Detected concentration in Groundwater to Screening Criteria" identifies several chemicals with Hazard Quotients exceeding one, including the following: arsenic (HQ=1.06), copper (HQ=117), lead (HQ=20.4), mercury (HQ=112), nickel (HQ=9.65), silver (HQ=5.53), selenium (HQ=1.04), zinc (HQ=2.47). The maximum concentrations shown on the table for nickel and silver are below their Hunters Point Groundwater Ambient Level (HGAL) therefore these chemicals do not exceed the Hunters Point Screening Level. The Navy has not adequately supported the removal of the metals in groundwater. Please retain these metals, with the exception of silver and nickel, as Chemicals of Concern for ecological receptors in the San Francisco Bay.	<ul style="list-style-type: none"> Appendix B of the TMSRA will be expanded to include additional explanation in the text as well as data tables and graphs illustrating the data for the requested chemicals to further support the discussion in the text of Section B5.1.2.3. No change to Section 3.2 of the report is proposed from this comment.

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41.	3-10	<u>Page 3-10, Section 3.3 Remediation Goals.</u> Please discuss the Remediation Goal for mercury shown on Table 3-18. DTSC requests that a Remediation Goal is proposed for the protection of human health from inhalation of mercury from groundwater and soil. Please propose ecological protective remediation goals for all metal Contaminants of Concern.	<ul style="list-style-type: none"> • Please refer to the response to EPA specific comment 21 regarding evaluation of vapor inhalation exposure to mercury in groundwater. The HHRA will be revised to evaluate vapor inhalation exposure to mercury in groundwater. Based on the exposure scenarios associated with the planned reuses of Parcel B, if mercury is identified as a COC in groundwater in the HHRA, then a human health-based remediation goal for mercury will be added to Table 3-18. • Follow-up: Mercury was identified as a COC in groundwater and a human health-based remediation goal was added to Table 3-18 for the potential future resident and the construction worker. • Please refer to the response to DTSC specific comment 26 regarding evaluation of exposure to mercury in soil. • Arsenic is the only other metal COC in A-aquifer groundwater (Table 3-18). Arsenic was not retained as a COPEC in the SLERA and therefore does not have a remediation goal listed. Arsenic was not retained as a COPEC based on limited frequency of detection. Arsenic was detected only once in the data set at a concentration above the screening criterion (38 µg/L detected versus 36 µg/L screening criterion) and all previous and subsequent samples from the same monitoring well indicated much lower concentrations. No change to Section 3.3 or Table 3-18 of the report is proposed from this comment.
42.	3-11	<u>Page 3-11, Section 3.4 Updated Risk Evaluation by Redevelopment Block.</u> Please provide a caveat in the text that explains the limitations of the data in accurately determining risk and that risk is likely underestimated for Redevelopment Blocks with little or no data.	<ul style="list-style-type: none"> • Please refer to the response to DTSC (Lanphar) specific comment 6.
43.	3-13	<u>Page 3-13, Section 3.4.4 Redevelopment Block 4.</u> Although data was not collected within Redevelopment Block 4, risk due to the ubiquitous chemical contaminants is assumed.	<ul style="list-style-type: none"> • Please refer to the response to DTSC (Lanphar) specific comment 6.

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44.	3-16	Page 3-16, Section 3.4.10 Redevelopment Block 12. Please update the discussion of the IR-25 groundwater plume based on the conclusions of the groundwater delineation study at RU-C5.	<ul style="list-style-type: none"> Please see the response to EPA specific comment 16. The text will be modified as follows. "...chloroform was not detected in the four most recent monitoring rounds (through May 2006). The Navy's recent investigation of VOCs along the boundary between Parcels B and C in this area did not show any additional information that would affect the IR-25 groundwater risk plume at Redevelopment Block 12."
45.	4-2	Page 4-2, Section 4.1.1 Remedial Action Objectives for Soil. Please include a Remedial Action Objective for protection of human health from inhalation risk from VOCs and mercury in soil.	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 26 concerning inhalation risk from the unsaturated zone.
46.	4-2	Page 4-2, Section 4.1.1 Remedial Action Objectives for Soil. The text states that no ecological RAOs were developed for soil at Parcel B; however, ecological RAOs for soil and sediment are presented in the last bullet of page 4-3.	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 41.
47.	4-2	Page 4-2, Section 4.1.1.1 Chemicals of Concern in Soil. Because of our understanding of the condition of fill at Hunters Point and the difficulty in meeting remediation goals during earlier remedial action, DTSC request that when a grid presents a potential unacceptable risk overlaps with more than one redevelopment block, the COCs and remediation goals are assigned to all redevelopment blocks and not just the redevelopment block where the samples were collected.	<ul style="list-style-type: none"> Remediation goals apply to all grids, independent of redevelopment block. However, the HHRA evaluates soil data based on the grid system; data are not shared or spread across grids and each grid is assigned to only one redevelopment block. Remediation alternatives are developed and evaluated by redevelopment block in the TMSRA to address the fact that some grids are characterized by only a few samples and that some grids contain no samples. The application of the selected remedial action will be supported by additional sampling (for example, confirmation samples from excavations) conducted during the remedial action phase.

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48.	4-5	Page 4-5, Section 4.1.2.2 <u>Groundwater Remedial Action Objectives for the Protection of Human Health</u> . Please include inhalation risk from mercury in groundwater when discussing Remedial Action Objectives for the vapor intrusion pathway. Because mercury is not adequately characterized at IR-26 and confirmation samples showed mercury at 90 mg/kg at ten feet, mercury is assumed to occur in groundwater in Redevelopment Block 16.	<ul style="list-style-type: none"> • If mercury is determined to be a COC, the text of the RAO in Section 4.1.2.2 will be revised as follows. "Prevent exposure to VOCs <i>and mercury</i> in A-aquifer groundwater above remediation goals via indoor inhalation of vapors from groundwater." • Follow-up: The RAO in Section 4.1.2.2 was revised. • The horizontal extent of mercury in soil to a depth of 10 feet bgs was delineated to the cleanup goal set in the ROD. All soil above the cleanup goal was removed. Excavation of soil above the cleanup goal stopped at 10 feet bgs in accordance with the ROD and ESD.
49.	4-5	Page 4-5, Section 4.1.2.3 <u>Groundwater Remedial Action Objectives for the Protection of the Environment</u> . Mercury is the only metal with a remediation goal for the protection of ecological receptors in San Francisco Bay. Please present chemical specific remediation goals that are protective of San Francisco Bay ecological receptors for all A-aquifer Chemicals of Concern (see table B-8).	<ul style="list-style-type: none"> • Mercury was the only chemical in groundwater that remained as a COPEC after the refinement step in the SLERA; therefore, it is the only chemical with a remediation goal for groundwater for the protection of the bay. • Please also refer to the response to DTSC (Lanphar) specific comments 40 and 41. • No change to the report is proposed from this comment.
50.	4-6	Page 4-6, Section 4.2 <u>Potential Applicable or Relevant and Appropriate Requirements and Appendix C</u> . DTSC believes that its statutes and regulations in general are applicable ARARs. Many state ARARS are listed as the Navy as only relevant and appropriate.	<ul style="list-style-type: none"> • The Navy requested that DTSC identify potential state ARARs in a letter dated October 21, 2003 and received a response dated December 24, 2003. This request specifically asked for identification of and citations to specific substantive sections and subsections of state laws and regulations as required by the NCP at 40 CFR § 300.400(g)(5). Only specific substantive provisions of statutes and regulations may qualify as ARARs pursuant to CERCLA and the NCP. The state response was more general than requested and required. Nonetheless, the Navy elected to proceed to address the general information provided by the state and has addressed all requirements identified by the state in the TMSRA ARARs analysis.

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51.	4-9	<p><u>Page 4-9, Section 4.2.3.1 Potential Action-Specific ARARs for Soil Alternative – Institutional Controls.</u> In this section and elsewhere in the TMSRA the Navy only identifies California Code of Regulations section 67391.1(e)(1) as an ARAR. First, the regulation should be cited in its entirety. Additionally, Civil Code section 1471, and Health and Safety Code sections 25202.5, 25221.1, 25355.5(a)(1)(C), 25233(c) and 25234 should be listed as ARARs.</p>	<ul style="list-style-type: none"> • The text of Section 4.2.3.1 will be revised identify Cal. Code Regs. Tit. 22, § 67391.1(a) and (e)(1) as the potential state ARAR. Similar changes will be made in Appendix C at Section C4.1.2.2 and Table C-6. • Follow-up: Cal. Code Regs. tit. 22 § 67391.1 was cited in its entirety. • The text of Section 4.2.3.1 will be revised to identify California Civil Code § 1471 and California Health and Safety Code §§ 25202.5, 25355.5(a)(1)(C), 25233(c), and 25234 as potential state ARARs for institutional controls. Similar changes will be made in Appendix C at Section C4.1.2.2 and Table C-6. • Follow-up: California Health and Safety Code §§ 25222.1 and 25232(b)(1)(A)-(E) were also included.
52.	4-14	<p><u>Page 4-14, Section 4.3.1 Development of General Response Action – Groundwater.</u> Removal is identified as a potential response action; however, only pumping is identified as a method. Please add source removal as another method for consideration. DTSC request that the removal of mercury remaining in soil below 10 feet (concentrations as much as 90 mg/kg in composite samples) be evaluated and retained as a remedial alternative.</p>	<ul style="list-style-type: none"> • Mercury source removal has been added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59.
53.	4-15	<p><u>Page 4-15, Section 4.3.2.1 Evaluation of Applicable Soil Process Options, Institutional Controls.</u> The first sentence is misleading or at least only partially representative of the applicability of ICs. ICs are often put in place as a permanent remedy to address contaminants left in place at a site at levels that do not allow unrestricted use. Those ICs will remain until someone conducts further remediation or can support that they are no longer needed due to the absence of contamination for some reason (e.g. natural attenuation, etc.) otherwise they will remain in place forever. Therefore, this sentence should be</p>	<ul style="list-style-type: none"> • The text describing institutional controls in Section 4.3.2.1 starting at the bottom of page 4-15 will be revised as follows. “Institutional controls are legal and administrative mechanisms used to implement land use and access restrictions that are used to limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances <i>present on the property</i> to maintain the integrity of the remedial action until remediation is complete and remediation goals have been achieved, <i>and to assure containment of hazardous substances remaining on the property in vapors, soils, or contaminated groundwater after remedial actions have been taken.</i> Institutional controls may remain on a property even after remediation goals have been met in cases where those goals were selected at levels that accounted for the application of institutional controls. Institutional controls may remain in place unless the remedial action taken would allow for

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		expanded to reflect that ICs could remain in place where remediation is complete and goals met, but only to levels that require ICs.	<p><i>unrestricted use of the property.</i> Monitoring and inspections are conducted...”</p> <ul style="list-style-type: none"> Proposed revised text for Section 4.3.2.1 discussing institutional controls is included as Attachment 2 to these responses.
54.	4-18	<p>Page 4-18, Section 4.3.2.1 <u>Evaluation of Applicable Soil Process Options, Institutional Controls - Restricted Land Uses</u>. This section should be re-written to indicate that the property can not be used for any of the restricted uses without seeking the approval of the Navy and DTSC per the requirements in their respective documents, the Quitclaim Deed(s) and the Covenant to Restrict Use of Property. DTSC has specific statutory requirements for granting variances, modifications, or terminations of restrictions in a Covenant to Restrict Use of Property.</p>	<ul style="list-style-type: none"> The text on page 4-16 in the following paragraph addresses the need for future transferees to seek approval from DTSC and the Navy. <p>“The ‘Covenant to Restrict Use of Property’ will incorporate the land use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC against future transferees. The Quitclaim Deed(s) will include the identical land use restrictions in environmental restrictive covenants that run with the land and that are enforceable by the Navy against future transferees.</p> This paragraph will be expanded by the addition of the following text which was included in the Navy’s August 9, 2006 redraft of this section developed in consultation with DTSC and EPA counsel. <p><i>“The ‘Covenant(s) to Restrict Use of Property’ and Deed(s) shall provide that a Parcel B Risk Management Plan (‘Parcel B RMP’) shall be prepared by the City of San Francisco and approved by the Navy and the FFA Signatories. The Parcel B RMP shall be discussed in the Parcel B ROD Amendment and shall be attached to and incorporated by reference into the Covenant(s) to Restrict Use of Property and Deed(s) as an enforceable part thereof. It shall specify soil and groundwater management procedures for compliance with the remedy selected in the Parcel B ROD Amendment. The Parcel B RMP shall identify the roles of local, state, and federal government in administering the Parcel B RMP and shall include, but not be limited to, procedures for any necessary sampling and analysis requirements, worker health and safety requirements, and any necessary site-specific construction and/or use approvals that may be required.”</i></p>

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55.	4-18	<u>Page 4-18, Section 4.3.2.1 Evaluation of Applicable Soil Process Options, Institutional Controls, Restricted Activities.</u> Please clarify that soil containment applies to all of Parcel B and is not limited to 'debris fill area cap/containment systems'.	<ul style="list-style-type: none"> The revised language in Section 4.3.2.1, which was included in the Navy's August 9, 2006 redraft of this section developed in consultation with DTSC and EPA counsel, will be revised as follows: "...revetment walls and shoreline protection, and debris-fill area cap/containment systems); groundwater extraction..."
56.	4-19	<u>Page 4-19, Section 4.3.2.1 Evaluation of Applicable Soil Process Options, Removal.</u> The explanation of the occurrence of ubiquitous metal contamination at concentrations above the HPALs, especially for arsenic and manganese is well stated. This type of explanation is needed earlier in the document and in the executive summary. Please add in the text that the ubiquitous metal contamination at concentrations above the HPALs is not considered ambient or naturally occurring.	<ul style="list-style-type: none"> Please refer to the response to EPA specific comments 1 and 5.
57.	4-19	<u>Page 4-19, Section 4.3.2.1 Evaluation of Applicable Soil Process Options, Containment.</u> a. Please emphasize that the Navy's soil covers are interim and temporary and would be replaced or altered during redevelopment. b. Please add to the text the statement that soil cover would apply to all of Parcel B and not just Redevelopment Blocks with data showing an unacceptable health risk. c. Please include the concrete and wooden sea walls along the Parcel B shore as existing containment systems. d. Please evaluate the condition of the seawalls for effectiveness and durability in containing contaminated soil found at Parcel B. e. Please discuss whether current landscaped areas provide adequate containment for soil contaminants. If not, please describe acceptable interim landscape	<ul style="list-style-type: none"> (a) While the covers installed by the Navy may be modified during redevelopment, the soil covers in Alternatives S-4 and S-5 are intended to be permanent and will prevent exposure to soil contamination. If soil covers are damaged or modified during redevelopment, they must be repaired or replaced. (b) The second bullet on page 4-20 will be replaced with the following text. <i>"Where covers are needed, areas will be covered with a durable material that will not break, erode, or deteriorate such that the underlying soil becomes exposed. Standard construction practices for roads, sidewalks, and buildings would likely be adequate to meet this performance standard. Other examples of covers could include a minimum 4 inches of asphalt, a minimum 2 feet of clean imported soil, and maintained landscaping. All covers must achieve a full cover over the entire redevelopment block. The exact nature and specifications for covers can vary from block to block, but all covers must meet the performance standard of preventing exposure to soil and being durable."</i> Follow-up: Maintained landscaping has been removed as an example cover type because it is not planned to be used as a significant cover type. (c) The concrete and wooden sea walls are not considered part of the permanent remedy.

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		containment systems.	<p>The Navy plans to maintain the revetment walls at IR-07 and IR-26 because they are part of the containment remedy. Sea walls at other locations in Parcel B hold back fill soil. Responsibility for these sea walls will be transferred to the SFRA and are not considered part of the CERCLA remedy.</p> <ul style="list-style-type: none"> (d) Soil contamination has been removed, to the extent practicable, adjacent to the sea walls by previous excavations (TPA-CKY 2005, Tetra Tech 2002a). Upon transfer, these structures and responsibility for their integrity will be transferred to the SFRA. (e) Please refer to the response to item (b).
58.	4-23	<p>Page 4-23, Section 4.3.2.2 <u>Evaluation of Applicable Groundwater Process Options – Passive Groundwater Treatment</u>. Passive groundwater treatment may be appropriate for volatile organic compounds (VOCs) since this is essentially biologic treatment using the native microorganisms that have been shown to exist at Hunters Point Shipyard through Treatability Studies. However, passive groundwater treatment is likely not appropriate for Mercury. The following is excerpted from the Commission on Geosciences, Environment and Resources, 2000, "Natural Attenuation for Groundwater Remediation", page 103.</p> <p><i>Mercury is sometimes present in soils and sediments at contaminated sites in the form of mercuric ion, Hg(II), elemental mercury, Hg(0), and the biomagnification-prone organic mercury compounds monomethyl- and dimethylmercury (both of which can accumulate at hazardous levels in the food chain). All microbial transformations of mercury are detoxification reactions that microbes use to mobilize mercury away from themselves (Barkay and Olson, 1986). Most reactions are enzymatic, carried out by aerobes and anaerobes, and involve uptake of Hg(II) followed by reduction of Hg(II) to</i></p>	<ul style="list-style-type: none"> The referenced report excerpt does not address the attenuation of mercury by humic substances and other organic matter in soil and groundwater. This process is discussed in EPA's Mercury Study Report to Congress Volume III, Fate and Transport of Mercury in the Environment (EPA 1997), which states (p. 2-11): "Soil conditions (e.g., pH, temperature and soil humic content) are typically favorable for the formation of inorganic Hg(II) compounds such as HgCl, Hg(OH) and inorganic Hg(II) compounds complexed with organic anions. Although inorganic Hg(II) compounds are quite soluble (and, thus, theoretically mobile) they form complexes with soil organic matter (mainly fulvic and humic acids) and mineral colloids; the former is the dominating process. This is due largely to the affinity of Hg(II) and its inorganic compounds for sulfur-containing functional groups." Clay minerals and iron oxides can also adsorb mercury species in soils of neutral or near neutral pH. Although methylmercury can also be formed in soil through microbial action on Hg(II) species, it will also be largely bound to organic matter. Appendix B of EPA's Mercury Study report goes on to present fate and transport parameters for mercury species in soil and water. Soil/water partition coefficients (Kd) ranging from 24,000 to 270,000 mL/g were calculated for Hg(II) species, and Kd's ranging from 2,700 to 31,000 mL/g were calculated for methylmercury. In addition, a Henry's Law constant of 7.1×10^{-10} atm-m³/mol was presented for Hg(II) species and of 4.7×10^{-7} atm-m³/mol for methylmercury. The size of the Kd's for the likely mercury species present in soil and groundwater at the site indicates a preference for sorption to soil. Thus, with removal of the source materials through excavation, it is likely that remaining Hg species dissolved in groundwater would attenuate through sorption into soil over time. Moreover, the very low Henry's Law constants show that the predominant dissolved mercury species are unlikely to volatilize

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		<p><i>volatile forms (elemental Hg(0) and methyl- and dimethylmercury) or the formation of highly insoluble precipitates with sulfide. In general, natural attenuation based on microbial mercury reduction and volatilization seems implausible because the volatile forms remain mobile, although immobilization as Hg(II) sulfides may be possible if the electron donors needed to sustain the microbial production of enzymes and the sulfate needed for precipitation are present together.</i></p> <p>Please remove Passive Groundwater Treatment as a Groundwater Process Option for mercury in groundwater.</p>	<p>from groundwater at concentrations that would pose risks to potential soil vapor receptors. It is for these reasons that groundwater monitoring was proposed as a groundwater process option for mercury in groundwater. As referenced in DTSC's comment, some mobile mercury would remain in groundwater and soil vapor due to complexation of Hg by dissolved organic carbon species and through microbial reduction of Hg compounds to elemental Hg(0). However, these mobile species would be predicted to amount to a small fraction of the total Hg present in the aquifer, which is already small (2.8 µg/L or less).</p> <ul style="list-style-type: none"> No change to the report is proposed from this comment. Follow-up: The clean fill used to backfill the excavation that will deepen Excavation EE-05 will act as a sink for mercury dissolved in groundwater based on the high sorptive capacity of the clean material.
59.	4-23	<p>Page 4-23, Section 4.3.2.2 Evaluation of Applicable Groundwater Process Options. Please include source removal of mercury in soil below 10 feet (concentrations as much as 90 mg/kg in composite samples) as an applicable groundwater process option. DTSC requests that the removal of mercury remaining in soil be evaluated and retained as a remedial alternative.</p>	<ul style="list-style-type: none"> Mercury source removal has been added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59.
60.	---	<p>Table 4-2: Screening of General Response Actions and Process Options for Groundwater, Page 1 of 6. Please identify the appropriate Contaminants of Concern (COCs) that Passive Treatment is being considered for. This process option may be effective for Volatile Organic Compounds but not for mercury and other metals. Please modify screening comments to reflect this.</p>	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 58 and EPA specific comment 61 for a discussion of mercury.

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61.	5-2 & 5-5	<p><u>Pages 5-2 and 5-5, Sections 5.1.1 and 5.2.2: Alternative S-2: Institutional Controls and Shoreline Revetment.</u></p> <p>a. DTSC agrees that institutional controls should be implemented parcel wide.</p> <p>b. The present concrete and wooden sea wall at parcel B currently serves a similar purpose as the proposed revetment wall would serve. Please include the maintenance of the sea wall as an institutional control in Alternative S-2.</p> <p>c. Do implementation costs estimates for Institutional Controls include long term regulatory oversight by DTSC or other agencies? If not, please include oversight costs.</p> <p>d. On Page 5-6 the discussion of Alternative S-3 (third bullet) states that the removal and disposal 6,000 cubic yards of contaminated sediment is part of the revetment wall element of the alternative. Please discuss the soil removal aspect of the revetment alternative in Alternative S-2.</p>	<ul style="list-style-type: none"> • (a) Comment acknowledged; no response necessary. • (b) The following text will be added to the description of Alternative S-2 on page 5-2. <i>"Institutional controls will be implemented to maintain the integrity of the shoreline revetment at Parcel B."</i> Please refer to the response to DTSC (Lanphar) specific comment 57 for additional discussion of sea walls. • (c) The Navy continues to discuss this policy issue internally. The draft final TMSRA will be revised accordingly after the issue is resolved. • (d) Please refer to the response to EPA specific comment 45. The third bullet on Page 5-6 will be revised with the following text: "...includes disposal of 6,000 cubic yards of contaminated sediment to establish appropriate grades and to allow placement of erosion control materials at appropriate elevations relative to sea level."
62.	5-3 & 5-7	<p><u>Pages 5-3 and 5-7, Sections 5.1.1 and 5.2.2: Alternative S-4: Covers, Methane Source Removal, Institutional Controls and Shoreline Revetment.</u></p> <p>a. Please apply the cover alternative to the entire Parcel B. Ubiquitous metal COCs that exceed remediation goals are expected to occur within all redevelopment blocks, even those with insufficient or no data.</p> <p>b. Please rewrite the second paragraph on page 5-7 to state that based on the HHRA and the ubiquitous nature of some metal COCs all redevelopment blocks require covers.</p> <p>c. DTSC is not able to concur that existing covers are</p>	<ul style="list-style-type: none"> • (a) While ubiquitous metals may pose unacceptable risk in areas that are currently not represented by sample data, it would be incorrect to assume this is always the case. Nevertheless, the Navy proposes to address all areas at Parcel B in the alternatives, although risk has not been quantified as occurring above background levels in all redevelopment blocks. The remedies will be protective of potential exposure to ubiquitous metals that may pose unacceptable risk. • (b) The second paragraph on page 5-7 will be replaced as follows: <i>"Covers will be required at all redevelopment blocks to prevent human exposure to ubiquitous metals in soil that may pose an unacceptable risk."</i> • (c) Navy conducted a site walk on August 12, 2006 to observe the covers and determined that, because of storm drain and sanitary sewer removal activities, Parcel B covers will need re-evaluation after these removal activities are completed. A site walk with the BCT

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		adequate for blocks 1, 4, 5, and 16. Please schedule a BCT site walk to evaluate existing cover and determine where new covers are required. Review of air photos show distressed vegetative soil covers in Redevelopment Blocks 1, 4, 5, and 16.	will be scheduled at that time.
63.	5-8	Page 5-8, Section 5.3.2 Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls. DTSC does not support passive treatment and long term monitoring of mercury as a groundwater remedy. Further, as stated in an earlier comment, DTSC does not agree with the list of Chemicals of Concern identified in Section 3.0. Long-term monitoring of metals currently included in the Parcel B Remedial Action Monitoring Program may be part of an appropriate groundwater remedy; however, these metals are not currently identified as Chemicals of Concern.	<ul style="list-style-type: none"> • Please refer to the response to DTSC (Lanphar) specific comments 40 and 41 regarding the determination of COCs. The groundwater monitoring program will focus on COCs. • Please refer to the responses to DTSC (Lanphar) specific comment 58 and EPA comment 61 for discussion on groundwater monitoring for mercury.
64.	5-8	Page 5-8, Section 5.3.2 Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls. As stated in an earlier comment, natural groundwater recovery is not appropriate for mercury contaminated groundwater. The mercury plume is adjacent to the bay and is not completely characterized. DTSC requests that the TMSRA includes mercury source removal as a groundwater alternative. Please include groundwater monitoring after source removal to determine if cleanup levels have been achieved. Two or more additional monitoring wells will be needed to complete a monitoring network for the mercury plume.	<ul style="list-style-type: none"> • Mercury source removal and three additional groundwater monitoring wells have been added to Alternatives S-3, S-4, and S-5. The Navy has installed two new groundwater monitoring wells in the area near well IR26MW47A. A third well will be installed within the area of Excavation EE-05 after selection of the final remedy and completion of the mercury source removal. Please refer to the response to EPA specific comment 59.

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65.	6-5	<u>Page 6-5, Section 6.1.2.1 Overall Protection of Human Health and the Environment: Alternative S-2.</u> Alternative S-2 is not fully protective of human health and the environment because it does not consider the existing sea walls. Including the maintenance of the sea wall in the institutional controls would increase the protectiveness of this alternative.	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comments 57 and 61.
66.	6-5	<u>Page 6-5, Section 6.1.2.2 Compliance with ARARs: Alternative S-2.</u> This alternative includes a revetment wall that is proposed along the shoreline and within the jurisdiction of the Bay Conservation and Development Commission (BCDC). Please include BCDC ARARs prior to making this determination. This comment applies to all soil alternatives that include the revetment wall.	<ul style="list-style-type: none"> The Navy has already identified the San Francisco Bay Plan at Cal. Code Regs. Tit. 14, §§ 10110 through 11990 as potential state location-specific ARARs (for example, see Table C-4). No change to the report is proposed from this comment.
67.	6-5	<u>Page 6-5, Section 6.1.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment: Alternative S-2.</u> The text states that Alternative S-2 would not reduce the toxicity or volume of hazardous substances because soil would not be treated or removed. However, on page 5-6 the discussion of Alternative S-3 (third bullet) states that the removal and disposal 6,000 cubic yards of contaminated sediment is part of the revetment wall element of the alternative. Please modify this analysis section accordingly.	<ul style="list-style-type: none"> The rating of Alternative S-2 will be changed to “poor” based on EPA specific comment 66.

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68.	6-5	<u>Page 6-5, Section 6.1.2.3 Long-Term Effectiveness: Alternative S-2.</u> The discussion of long-term effectiveness does not consider the need to support reuse of Parcel B. Please discuss in this section how this alternative would support reuse and the continued long-term protection of future residents, visitors and workers. This alternative does not include maintenance of soil covers and therefore does not protect future residents, visitors and workers from exposure to contaminated soil. DTSC's conclusion is that the overall rating for Alternative S-2 for long-term effectiveness is poor. Please change the rating of this criterion 'good' to 'poor'.	<ul style="list-style-type: none"> Alternative S-2 would effectively prevent human exposure to COCs through institutional controls. If existing covers are not adequate to prevent exposure, access to those areas would be restricted under Alternative S-2. No change to the report is proposed from this comment.
69.	6-6	<u>Page 6-6, Section 6.1.2.5 Short-Term Effectiveness: Alternative S-2.</u> Please evaluate the short-term impacts of this alternative on the artists that are now located within Redevelopment Block B-4. Although no sampling occurred within this redevelopment block, ubiquitous metal contaminants of concern are likely present within this area. The buildings within the Redevelopment Block are surrounded with landscaped areas. The condition of this landscaping and its effectiveness in blocking contaminant pathways has not been evaluated. This alternative would not require maintenance of any cover in this area and erecting fencing may not be suitable as a remedy. DTSC's conclusion is that the overall rating for Alternative S-2 for short-term effectiveness is poor. Please change the rating of this criterion 'very good' to 'poor'.	<ul style="list-style-type: none"> Alternative S-2 would effectively prevent human exposure to COCs through institutional controls. Access will be restricted in areas where existing covers are not adequate to prevent exposure. The rating for Alternative S-2 for short-term effectiveness will be changed to good.

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70.	6-7	Page 6-7, Section 6.1.2.8 Overall Rating: Alternative S-2. Because of the issues identified in the above comments, please change the Overall Rating of S-2 from 'good' to 'poor'.	<ul style="list-style-type: none"> Please refer to the responses to DTSC (Lanphar) specific comments 67, 68, and 69.
71.	6-7	Page 6-7, Section 6.1.3 Individual Analysis of Alternative S-3. Alternative S-3 does not include the enhancement and maintenance of existing covers or the establishment of new covers; therefore, similar issues exist with Alternative S-3 as were identified by DTSC with Alternative S-2. Please change the ratings for Long-Term Effectiveness, Short-Term Effectiveness and Overall Rating from 'very good' to 'poor'.	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 68.
72.	6-10	Page 6-10, Section 6.1.4.1 Overall Protection of Human Health and the Environment: Alternative S-4. Please change this alternative to include covers over the entire Parcel B. Limiting the covers to Redevelopment Blocks where there is an unacceptable incremental risk limits the overall protection of human health and the environment. As currently written the alternative would not protect human health and the environment from the ubiquitous COCs that are found parcel-wide. Some redevelopment blocks have no data or insufficient data to support a risk assessment and the identification of incremental risks. Please change to rating for Overall Protection of Human Health and the Environment to 'not-protective'. If covers are required for the entire parcel, then the rating for this criterion could change to 'protective'.	<ul style="list-style-type: none"> Section 6.1.4 will be revised as follows: "Alternative S-4 includes (1) <i>covers over all redevelopment blocks to prevent human exposure to ubiquitous metals that may pose an unacceptable risk</i>, (2)..." Section 6.1.4.1 will be revised with the following text: "Alternative S-4 provides protection ...based on future land use <i>and soil with ubiquitous metals</i> would be covered. These covers..."

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73.	6-10	<p><u>Page 6-10, Section 6.1.4.3 Long-Term Effectiveness: Alternative S-4.</u> As currently written this alternative only requires covers for Redevelopment Blocks where there is an unacceptable incremental risk. Therefore, several Redevelopment Blocks, including RD-4 would not have a cover. Institutional controls would not require maintenance of covers in these redevelopment blocks. Therefore this alternative does not protect future residents, visitors and workers from ubiquitous Chemicals of Concern. Please change this alternative to include covers over the entire Parcel B. If the Alternative remains unchanged, please change to rating for Overall Protection of Human Health and the Environment from 'very good' to 'poor'. If covers are required for the entire parcel, then the rating for this criterion should stay as 'very good'.</p>	<ul style="list-style-type: none"> Section 6.1.4.3 will be modified as follows: "The factors evaluated... Under Alternative S-4, risks associated with exposure to COCs <i>and ubiquitous metals</i> in soil are mitigated by covering the soil. <i>The Navy proposes to use covers over all redevelopment blocks (informally termed 'full lot coverage')</i>. As a result..."
74.	6-11	<p><u>Page 6-11, Section 6.1.4.5 Short-Term Effectiveness: Alternative S-4.</u> As currently written this alternative only requires covers for Redevelopment Blocks where there is an unacceptable incremental risk. Therefore, several Redevelopment Blocks, including RD-4 would not have a cover. Buildings on RD-4 house the artist tenants at Hunters Point. The artist may not be protected from ubiquitous contaminants of concern in the short term if covers in RD-4 are not established or maintained. Although covers would not be required in this alternative, some covers currently exist within RD-4. Please change the overall rating for this criterion from 'very good' to 'good'.</p>	<ul style="list-style-type: none"> The Navy proposes to cover all areas at Parcel B and these covers will be protective of potential exposure to ubiquitous metals that may pose unacceptable risk. No change is necessary in Section 6.1.4.5 based on this comment.

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75.	6-12	Page 6-12, Section 6.1.5 <u>Individual Analysis of Alternative</u> . The above comments on the soil cover being limited to Redevelopment Blocks where there is an unacceptable incremental risk also apply to Alternative S-5. Please modify this section accordingly.	<ul style="list-style-type: none"> Section 6.1.5 will be revised as follows: "Alternative S-5 combines... and lead that pose a potential unacceptable risk and <i>covers over all redevelopment blocks to prevent human exposure to ubiquitous metals that may pose an unacceptable risk.</i>" Section 6.1.5.1 will be revised with the following text: "Alternative S-5 provides ...and all other soils <i>parcel-wide would be covered.</i> Institutional controls ..."
76.	6-20	Page 6-20, Section 6.3.2.1 <u>Overall Protection of Human Health and the Environment: Alternative GW-2</u> . DTSC does not concur that this alternative is protective of Human Health and the Environment. Natural recovery or passive treatment is not appropriate for mercury contaminated groundwater. Please change the conclusion for this criterion from 'protective' to 'not-protective'.	<ul style="list-style-type: none"> Please refer to the responses to DTSC (Lanphar) specific comment 58 and EPA specific comment 61. No change to the rating is proposed from this comment.
77.	6-20	Page 6-20, Section 6.3.2.2 <u>Compliance with ARARs: Alternative GW-2</u> . The text states that no Chemical Specific ARARs are pertinent to Alternative GW-2 because no active treatment or removal of groundwater is proposed. This alternative proposes groundwater monitoring and passive treatment. Remediation goals are necessary for passive treatment; otherwise one would not know if passive treatment is successful. However, the Navy does identify Chemical Specific ARARs for the protection of San Francisco Bay on Table 3-18. Please discuss the compliance of this alternative with chemical specific ARARs of the Bay Area Regional Water Quality Control Board.	<ul style="list-style-type: none"> The value for mercury from Table 3-3 of the Basin Plan is identified on Table 3-18 as a chemical-specific ARAR for groundwater. Chapter 3 of the Basin Plan is discussed as a chemical-specific ARAR in Section 4.2. The first sentence of the discussion of the compliance of Alternative GW-2 with ARARs will be replaced with the following. "<i>Chemical-specific ARARs pertinent to Alternative GW-2 would be met through removal of the mercury source and subsequent groundwater monitoring.</i>"

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78.	6-20	<u>Page 6-20, Section 6.3.2.3 Long-Term Effectiveness and Permanence: Alternative GW-2.</u> This alternative incorrectly assumes that mercury contaminated groundwater can be passively treated and does not include the removal of the source of mercury contaminated groundwater. Therefore, DTSC requests that the conclusion of criterion be changed from 'good' to 'poor'.	<ul style="list-style-type: none"> • Please refer to the responses to DTSC (Lanphar) specific comment 58 and EPA specific comment 61. • Mercury source removal will be added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59.
79.	6-20	<u>Page 6-20, Section 6.3.2.4 Reduction of Toxicity, Mobility or Volume: Alternative GW-2.</u> DTSC agrees with the Navy's conclusion that the overall rating for this criterion is poor. An additional reason for this conclusion is the leaving of mercury in soil at 10 feet below ground surface at 90 mg/kg. This mercury is a likely source for mercury in groundwater at IR-26.	<ul style="list-style-type: none"> • Mercury source removal will be added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59.
80.	6-21	<u>Page 6-21, Section 6.3.2.5 Short-Term Effectiveness: Alternative GW-2.</u> DTSC agrees that Institutional Controls for the protection of human health would be effective in the short-term. This alternative, however, does not address ongoing releases to the San Francisco Bay. Mercury at IR-26 has not been adequately characterized and mercury sources are still present in the soil at 10 feet below ground surface. Please change the conclusion of this criterion from 'excellent' to 'poor'.	<ul style="list-style-type: none"> • Mercury source removal will be added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59.
81.	6-22	<u>Page 6-22, Section 6.3.2.8 Overall Rating: Alternative GW-2.</u> DTSC does not agree with the Navy's overall rating for Alternative GW-2. This alternative leaves a mercury source of groundwater contamination in place, and therefore is neither effective in the short nor long term. Please change the overall rating for this alternative from 'good' to 'poor'.	<ul style="list-style-type: none"> • Mercury source removal will be added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59. • Concentrations of mercury in groundwater will be monitored by Alternative GW-2. Please refer to the responses to DTSC (Lanphar) specific comment 58 and EPA specific comment 61.

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82.	6-22	<p>Page 6-22, Section 6.3.3 <u>Individual Analysis of Alternative GW-3A and -3B</u>. The description of this alternative in Section 5 states that the monitoring and institutional control elements of GW-2 are included in this alternative as well. The text in Section 6.3.3 states that monitoring in this alternative would occur over for significantly less time. This alternative includes groundwater monitoring and in situ treatment of VOC plums but it does not state whether passive treatment of mercury in groundwater at IR-26 is also included. Please clarify. If passive treatment is envisioned by Alternative 3-A and 3-B, then DTSC comments on Section 6.3.2 also apply. If mercury in groundwater is not considered by this alternative than a major groundwater concern is not being addressed and Alternative 3-2 and 3-B will not be able to meet threshold criteria.</p>	<ul style="list-style-type: none"> • Alternatives GW-3A and GW-3B include monitoring groundwater. Please refer to the response to EPA specific comment 59 for changes to Section 6.3.3. • Please refer to responses to DTSC (Lanphar) specific comment 58 and EPA specific comment 61 for discussion on the monitoring of mercury in groundwater.
83.	6-22	<p>Page 6-22, Section 6.3.3 <u>Individual Analysis of Alternative GW-3A and -3B</u>. DTSC supports the inclusion and evaluation of in situ groundwater remediation. Clean up goals for the protection of human health, through the inhalation pathway, and of aquatic receptors in the San Francisco Bay are needed to determine whether this alternative meets the threshold criteria.</p>	<ul style="list-style-type: none"> • The TMSRA identifies remediation goals in Section 3.0 for groundwater in conjunction with the results of the risk assessments to target areas in groundwater that may require remediation. • The first full paragraph of Section 5.3.2 on page 5-9 will be revised as follows. "Groundwater in the A-aquifer would be monitored where concentrations of metals and VOCs are detected <i>above remediation goals</i>. The general objectives for groundwater monitoring...adjust the data collection and analysis requirements, and evaluate the need for other response actions. <i>Groundwater monitoring would continue until remediation goals are met.</i>"

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84.	6-25	<p><u>Page 6-25, Section 6.4 Comparison of Groundwater Remedial Alternatives.</u> DTSC does not agree that Alternatives GW-2, GW-3A and -3B meet the threshold criteria and are protective of human health and the environment.</p> <p>These alternatives have not adequately address mercury at IR-26 because the source of mercury in groundwater is not considered nor is the inhalation pathway for mercury evaluated. The removal of several metals as groundwater Chemicals of Concern has not been adequately supported. DTSC request that the groundwater monitoring alternative include the continuation of groundwater monitoring for several metals and VOCs along the Parcel B shoreline.</p> <p><i>Reasons: concerns over groundwater data quality, wells not in proper places (gap along IR-20/IR-26).</i></p>	<ul style="list-style-type: none"> • Inhalation exposure to mercury will be evaluated for each plume-based and nonplume-based exposure area where mercury is detected in groundwater. Please refer to the response to EPA specific comment 21. • Mercury source removal will be added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59. • Please refer to the response to DTSC (Lanphar) comments 40 and 41 regarding the development of COCs.
Additional Comments (dated September 1, 2006)			
1.		<p><u>Soil Vapor Remedial Action Objectives, Goals, and Alternatives.</u> In our original comments on the draft TMSRA DTSC requested soil gas Remedial Action Objectives (RAOs) for the protection of human health from the inhalation of VOCs and mercury. The establishment of RAOs for soil vapor implies that remedial alternatives be developed. DTSC wishes to clarify the need for Remedial Action Goals (RAGs) and soil remedial alternatives that address methane, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and mercury. Please establish remedial alternatives for soil gas sites with VOCs, mercury and methane in the soil or groundwater including: IR07 and IR18; IR10; the Parcel B/C boundary area near IR06 and IR25; IR20, and IR26. Please apply RAOs and RAGs to areas overlying total petroleum hydrocarbon</p>	<ul style="list-style-type: none"> • Section 4.1.2.2 on page 4-5 contains the RAO for protection of human health for exposure to VOCs via inhalation. The Navy will evaluate the potential risk to human health from exposure to mercury via inhalation (see response to EPA specific comment 21). If mercury is found to pose unacceptable risk via inhalation, an RAO will be added to Section 4.1. • Follow-up: Mercury was identified as a COC in groundwater and a human health-based remediation goal was added to Table 3-18 for the potential future resident and the construction worker. • Section 4.1.1.2 on page 4-3 contains the RAO and remediation goal for methane. • The TMSRA includes remediation alternatives to address exposure to VOC vapors and methane, and will be updated to incorporate alternatives for mercury vapor if it is determined to pose unacceptable risk. Other compounds listed in the comment (SVOCs, PAHs, and TPH) were not found to pose unacceptable risk via inhalation and, therefore, do not have corresponding RAOs or remediation alternatives. TPH that is not

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		<p>(TPH) and semi-VOCs (or polynuclear aromatic hydrocarbon (PAHs)) contamination (e.g. if naphthalene is present).</p> <p>The list of COCs for soil on Table 3-17 does not include all VOCs that are of concern, including daughter products of VOCs, such as vinyl chloride (VC) and dichloroethene (DCE). Please include these as COCs for soil. Please include a table similar to Table 3-17 for COCs in soil gas and please include risk based screening levels for soil gas, ambient air and indoor air.</p>	<p>commingled with CERCLA-regulated substances is not addressed in the TMSRA, but is, instead, addressed by the Navy's corrective action program for TPH. A revised corrective action plan for TPH at Parcel B is currently being prepared.</p> <ul style="list-style-type: none"> The Navy proposes to implement institutional controls for vapor intrusion across all of Parcel B based on ease and efficiency of implementation, consistency in long-term enforcement, and effectiveness of long-term maintenance. These institutional controls will eliminate potential exposure via vapor intrusion, whether the source of the vapor is soil or groundwater. Also refer to the response to additional comment 3, below. Exposure to VOCs via inhalation was evaluated based on vapor intrusion from groundwater; consequently, vinyl chloride and cis- and trans-1,2-dichloroethene are listed as COCs on Table 3-18, not Table 3-17.
2.		<p><u>Methane</u>. The removal of the methane source and post removal monitoring is proposed for sites 7 and 18 and DTSC agrees with this proposal. Navy's soil gas investigation of the site also identified the presence of VOCs in soil gas. The remedial alternative for sites 7 and 18 should also consider continued monitoring of VOCs as well as the removal or control of residual soil gas. Engineering controls for soil gas mitigation may be necessary for portions (Blocks 1, 2 and 3) of sites 7 and 18 where future mixed use or research and development reuse is specified.</p> <p>Further, the 5 percent Remedial Action Goal for methane is based on California Regulations for the control of methane within and at the boundary of landfills. Five percent (5%) is approximately the lower explosive limit (LEL: 53,000 ppmv) of methane. DTSC's approach to methane is outlined in <u>Advisory on Methane Assessment and Common Remedies at School Sites</u> (Advisory), June</p>	<ul style="list-style-type: none"> Vapor controls are proposed parcel-wide as part of the institutional controls discussed in Section 4.3.2.1. Monitoring of methane or VOCs may be required as part of the vapor controls if structures are built above areas with residual methane or VOC contamination. Vapor control and vapor monitoring details will be summarized in the RMP. The cited advisory on methane assessment is not promulgated or enforceable; consequently, remediation goals cannot be based upon it. However, the Navy will consider the information in this advisory during the remedial design to help identify appropriate soil gas monitoring requirements to be implemented during and following the methane source removal. No change to the report is proposed from this comment.

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		<p>16, 2005). The Advisory comprises detailed recommendations for investigation, remediation, and monitoring. Although developed for school sites, the Advisory is useful for all sites with methane contamination. The following recommendations with respect to remedial action objectives for methane are derived from the Advisory.</p> <p>a) Prevent methane in soil gas above a concentration of 0.5% (5,000 ppmv) (with a detection limit of 500 ppmv) from accumulating under proposed or current structures. Methane will migrate in response to both concentration and pressure gradients: therefore, the RAO should be stated in terms of pressures as well as concentrations (i.e., prevent methane at pressures above 0.5 pounds per square inch (psi), from accumulating under proposed or current structures).</p> <p>b) Remove or treat soils containing methane at 5,000 ppmv or above.</p> <p>c) Where subsurface methane levels are above 1,000 ppmv under proposed or current structures, propose an active or passive venting system.</p>	
3.		<p><u>Contaminants of Concern.</u> Currently, chemicals of concern (COCs) are specific to redevelopment blocks. This is appropriate for risk assessment, because in a risk assessment COCs are identified using detected contaminants. However, because of the current understanding of contamination at Hunters Point and the uncharacterized nature of many redevelopment blocks, limiting chemicals of concern to the redevelopment block is not appropriate for contaminants that may be of concern parcel wide. Parcel wide chemicals of concern are needed</p>	<ul style="list-style-type: none"> Chemicals of concern are identified for each exposure area in the HHRA. For Parcel B, exposure areas are defined using a grid for residential and industrial exposures, and COCs are, therefore identified by grid cell. Exposures and COCs are not evaluated on a redevelopment block or parcel-wide basis. COCs are summarized for presentation in the tables in Section 3.0 by redevelopment block for ease of reference, but the selection of COCs is done at the grid level. No change to the report is proposed from this comment.

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		to support a parcel wide soil cover and for future redevelopment risk management plans. Please produce a list of parcel wide chemicals of concern and a corresponding list of parcel wide remediation goals.	
4.		<p><u>Groundwater Vapor Intrusion Risks and Engineering Controls.</u> In the discussion of Alternative GW-2: Long-Term Groundwater Monitoring and Institutional Controls the Navy states, "Institutional Controls would be in place to prohibit occupancy of buildings or other enclosures where there is potential unacceptable risk from the vapor intrusion pathway and require engineering controls on all new buildings constructed in redevelopment blocks where groundwater plumes may present potential unacceptable risk from vapor intrusion pathway." This statement implies that engineering controls would be required for all new buildings within the entire redevelopment block and not just for those buildings situated above groundwater plumes or the plumes buffer zone. Figure A-8 shows the potential lateral extent of groundwater vapor intrusion, while Figure 3-8 shows only the affected grid. Please clarify that a redevelopment block will require Institutional Controls and Engineering Controls if the potential lateral extent of vapor intrusion extends into that redevelopment block. Engineering Controls may not be necessary if the Navy can show through groundwater and soil vapor sampling that a vapor intrusion risk is not present.</p> <p>Please explain the Engineering Controls required for existing buildings that are in affected redevelopment blocks and will be reused as part of the redevelopment.</p>	<ul style="list-style-type: none"> • The description of Alternative GW-2 on page 5-9 will be revised as follows. • "Institutional controls are part of Alternative GW-2 and are described in detail in Section 4.3. Institutional controls would be in place to prohibit occupancy of buildings or other enclosures where there is potential unacceptable risk from the vapor intrusion pathway and require engineering controls on all new buildings <i>occupied</i> in redevelopment blocks where groundwater plumes may present potential unacceptable risk from the vapor intrusion pathway. <i>Institutional controls will be required for an entire redevelopment block if any portion of that block is affected by the potential lateral extent of vapor intrusion. Figure A-8 presents the potential lateral extent of vapor intrusion and shows that all redevelopment blocks, except blocks 1, 2, 4, and BOS-3, would require institutional controls for vapor intrusion. The Navy proposes to implement institutional controls for vapor intrusion across all of Parcel B based on ease and efficiency of implementation, consistency in long-term enforcement, and effectiveness of long-term maintenance. Institutional controls for vapor intrusion will remain in place as long as the underlying groundwater exceeds remediation goals.</i>"

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5.		<p><u>Threats to Groundwater from Contamination Left in Place.</u> There are several instances where contamination is not considered in the risk assessment because the contamination is below the cut off depth for inclusion into the risk assessment (three feet for open space; 10 feet for industrial or residential). This contamination may still pose a threat to groundwater and surface water. Mercury at IR-26 is one example of contamination left in place that is not addressed in the risk assessment and continues to pose a risk to surface and groundwater. The issue of mercury at IR-26 was included in DTSC's original comments on the draft TMSRA. However, other contaminants left in place have not been discussed in the TMSRA. Contamination left in place is important when considering changes to the groundwater monitoring program. Please discuss contamination left in place and its potential affect on groundwater and surface water. Please address contamination left in when supporting changes to the groundwater monitoring program for Parcel B and evaluate the need for additional excavations to remove this contamination. Below are some examples of contamination in soil left in place.</p> <p>Aroclor -1260: 50 mg/kg (0705N2G at 4 fbgs, in BOS-1), 14 mg/kg (0704P41 at 3 fbgs, in Block 3).</p> <p>Arsenic: 929 mg/kg (IR07B017 at 31 fbgs, in BOS-2), 240 mg/kg (0704BC93 at 3 fbgs, in Block 3).</p> <p>Asbestos: Chrysotile asbestos up to 5% at IR24. Up to 15% in earlier reports at BB2-7 and BB2-10.</p> <p>Copper (Cu): 5,400 mg/kg (IR071T020 at 3.5 fbgs, BOS-1).</p>	<ul style="list-style-type: none"> Mercury source removal will be added to Alternatives S-3, S-4, and S-5. Please refer to the response to EPA specific comment 59. Quarterly groundwater monitoring at Parcel B since 1999 has not indicated that new, previously undiscovered sources of groundwater contamination exist at Parcel B. Contaminants that may remain in place have not affected groundwater to date and are not expected to affect groundwater in the future. Aroclor-1260 is only slightly soluble in water and is not expected to create a groundwater problem. Groundwater samples from RAMP well IR07MW20A1 downgradient from sample IR07B017 and wells IR07MW26A, IR07MWS-2, and IR07MW20A1 downgradient from sample 0704BC93 have not exceeded the RAMP trigger level for arsenic. Asbestos is a concern as an airborne contaminant and is not expected to create a groundwater problem. Groundwater samples from RAMP well IR07MW20A1 downgradient from sample IR071T020 have not exceeded the RAMP trigger level for copper. Groundwater samples from RAMP wells at IR-07 have not indicated a plume of dissolved lead exists at this area. Isolated samples (nearly all collected during a single event in September 2004) have exceeded the lead trigger level, but do not indicate a consistent pattern of elevated detections that would identify a plume. Mercury concentrations in bottom composite samples at Excavation EE-05 are proposed to be removed by the mercury source area excavation to mitigate their potential affect on groundwater. Groundwater samples from RAMP well IR07MW26A downgradient from sample IR07B036 have not exceeded the RAMP trigger level for mercury. Groundwater samples from RAMP wells IR07MW19A, IR07MWS-2, and IR07MW20A1 downgradient from sample IR23B013 have not indicated detections of tetrachloroethene. The TMSRA proposes remediation alternatives to address TCE in soil and groundwater in the area of Redevelopment Block 8 (IR-10).

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		<p>Lead (Pb): 17 locations at 1,000 mg/kg or greater, including 44,200 mg/kg (0704S1E at 8.5 fbgs, in BOS-1) and 8,540 and 8,380 mg/kg (0704BC1 and 0071B12 at 10 and 7 fbgs, in BOS-1), 5,120 and 4,540 mg/kg (IR07B050 and IR07016 at 10 and 16 fbgs, in "OTHER" about 20 feet from residential Block 6).</p> <p>Mercury (Hg): 90.1, 80.6, and 38.6 mg/kg (EE05BC11, EE05BC05, and EE05BC08 all at 10 fbgs, in Block 16) and 20.1 mg/kg (IR07B036 at 31 fbgs, in BOS-1). Six other locations in EE05 area had Hg greater than 10 mg/kg.</p> <p>Tetrachloroethene (PCE): 2.8 mg/kg (IR23B013 at 1.8 mg/kg, in Block 6).</p> <p>Trichloroethene (TCE): Block 8 has 11 locations with TCE in soil at 100 mg/kg or greater, including 980 mg/kg (IR10B036 at 11 fbgs). There are 70 locations on Block 8 with TCE greater than 10 mg/kg.</p>	
6.		<p><u>Northwestern Boundary with Private Property.</u> The data indicate that Parcel B contamination (e.g., IR18 and IR07 area) extends beyond the adjacent boundary into occupied private property on the northeast. The extent of contamination on adjacent private property has not been determined. This is especially a concern with respect to mobile contaminants, like total petroleum hydrocarbons (TPH), which may also entrain other contaminants. For example, TPH contaminated soil at the property boundary was excavated and backfilled: excavations did not extend beyond the property boundary. However, if TPH remains under adjacent property, contaminants may migrate into the backfill, re-contaminating Parcel B. Please discuss in the TMSRA how the Navy intends to address this</p>	<ul style="list-style-type: none"> • Remediation alternatives in the TMSRA address contaminants at HPS. For example, Alternatives S-4 and S-5 will provide a cover over all of the areas of IR-07 and IR-18 along the northwestern property boundary. Although contaminant transport through soil would be expected to be minimal, any soil migrating onto Parcel B would be addressed by the cover and the on-going institutional controls that will require maintenance of the cover. Free-phase liquids, including hydrocarbons, were not observed in excavations along the northwestern property boundary (Tetra Tech 2002a, SulTech 2004). TPH that is not commingled with CERCLA-regulated substances is not addressed in the TMSRA, but is, instead, addressed by the Navy's corrective action program for TPH. A revised corrective action plan for TPH at Parcel B is currently being prepared. • The Navy does not intend to extend remedial action onto the adjacent private property. No change to the report is proposed from this comment.

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		contamination.	
7.		<u>Asbestos Regulations</u> . Asbestos airborne toxic control measures for construction, grading, quarrying, and surface mining operations (California Code of Regulations, Title 17, Section 93105) are identified as an ARAR for constructing the Shoreline Revetment and Covers for the Soil alternative. Please include this ARAR for the excavation and off-site disposal alternative.	<ul style="list-style-type: none"> The following bullet will be added to the list of bullets for the excavation and off-site disposal alternative on page 4-10. <i>“Asbestos airborne toxic control measure for construction, grading, quarrying, and surface mining operations at Cal. Code Regs. tit. 17, § 93105 ”</i>

TABLE 3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC), Human and Ecological Risk Division (HERD) on the “Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated March 28, 2006. Comments were submitted by James Polisini (HERD) on June 19, 2006. Throughout this table, *italicized* text represents proposed additions to the TMSRA and ~~strikeout~~ text indicates locations of proposed deletions. These responses were submitted on December 8, 2006 and discussed with DTSC during meetings on January 9 and 23, 2007. Additional information related to a response as a result of further discussions is identified in this table as “**Follow-up**” at the end of a response. DTSC provided comments on the responses in this table in a letter dated March 6, 2007. These additional DTSC comments are provided in a separate attachment. Throughout this table, references to page, section, table, and figure numbers pertain to the draft TMSRA, even though some of these numbers have changed in the draft final TMSRA.

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General Comments			
1.	---	<p>The version of the document furnished for review in Adobe PDF format on CD-ROM is locked to prevent copying. This prevents transfer of portions of the document text into the HERD comment memorandum without re-typing the entire portion of the text commented upon. Please furnish an unlocked version, or supply the encryption password, of future documents submitted for HERD review.</p> <p>The HHRA evaluates the Exposure Point Concentration (EPC) based on Redevelopment Blocks. These Redevelopment Blocks are based on potential future use as “reasonably anticipated”. Grids within each Redevelopment Block are evaluated for residential, industrial and recreational exposures regardless of the currently-planned future use. HERD recommends a deed restriction, or some mechanism of equivalent standing, be implemented to prohibit future residential or mixed land use for Redevelopment Blocks evaluated as industrial exposure.</p> <p>The HHRA is generally well prepared and presented. However, HERD recommends several different exposure parameters and modeling parameters be used to recalculate exposure via several</p>	<ul style="list-style-type: none"> Documents are distributed to the public (for example, the restoration advisory board) concurrently with the regulatory agencies and all receive the same files. Electronic versions are locked to prevent unauthorized changes to the reports. Recent upgrades to Adobe Acrobat 6 now allow for file creation that allows copying; future documents will be submitted to DTSC with the capability to copy text and figures. Institutional controls are included as part of all remediation alternatives. Section 4.3.2.1 will be revised as discussed in the response to DTSC (Lanphar) specific comment 54 to describe the risk management plan (RMP) that will be part of the institutional controls. The RMP will contain provisions for site-specific use requirements that can be structured to require only industrial use in areas that were evaluated for industrial exposure by the TMSRA HHRA. Mechanisms for implementing future institutional controls are being prepared collaboratively among the Navy, the City of San Francisco, and the regulatory agencies. Responses to questions concerning exposure parameters used in the HHRA and SLERA are included in responses to specific comments later in this document.

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		<p>exposure pathways.</p> <p>The ERA is generally well prepared and presented. However, HERD recommends presentation of several additional lines of evidence, such as inclusion of field collected tissues.</p>	
Specific Comments for the Human Health Risk Assessment			
1.	1-2 & 2-12	<p>U.S. EPA guidance for calculating human health risk for sites with both chemical and radiological contamination requires risk from chemical contaminants to be summed with risk from radiological contaminants when evaluating remedial alternatives (OSWER, 1997). Radiological issues are scheduled to be addressed in “a future radiological addendum to the TMSRA (Section 1.1, page 1-2; Section 2.1.5.4, page 2-12). Total Parcel B human health risk from chemical contaminants and radiological contaminants cannot be determined at this time. HERD recommends amendment to the Parcel B Record of Decision (ROD) be delayed until the radiological issues are addressed.</p>	<ul style="list-style-type: none"> Comment acknowledged. The Navy agrees that the ROD amendment for Parcel B cannot be completed without an evaluation of human health risk based on potential exposure to radiological contaminants. These evaluations are on-going and will be included in the radiological addendum to the TMSRA.
2.	A-8	<p>Only data qualified as rejected (R) are noted as not included in the Parcel B HHRA (Section A4.1, page A-8). Please clarify how data qualified as non-detect (U) or estimated below Laboratory Reporting Limit (UJ) was used in the HHRA.</p>	<ul style="list-style-type: none"> The second paragraph of Section A4.1 on page A-8 will be revised as follows. “Consistent with EPA guidance, only data qualified as rejected (R) were considered unusable for the risk assessment (EPA 1989). <i>For soil, U- and UJ-qualified data were incorporated into the HHRA by using a proxy concentration of one-half of the sample quantitation limit for each exposure area evaluated, provided the chemical was detected at least once. If the chemical was not detected in any samples for the exposure area, then the chemical was excluded from further evaluation from that exposure area. For groundwater, U- and UJ-qualified data were excluded from the HHRA. Estimated (J-qualified) concentrations were included in the HHRA groundwater data set. Data quality issues...</i>” Please also refer to the response to EPA general comment 2 on Appendix A.

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3.	---	Many COPCs in residential grid units are represented by 1, 2 or 3 samples (Table A1-1 through A1-2). Risk and/or hazard evaluation criteria must be protective with this low level of characterization. The level of characterization in grid units immediately adjacent to any grid units with elevated risk and/or hazard values should be carefully evaluated before setting the boundary of any "hot spot".	<ul style="list-style-type: none"> The HHRA contains no discussion of hot spots and does not use the concept of hot spots in evaluating risk. The grid is the basic unit of characterization for the HHRA; data are not shared between soil grids. Remediation alternatives are developed and evaluated in the TMSRA to address the fact that some grids are characterized by only a few samples and that some grids contain no samples.
4.	---	Upon visual inspection, a significant proportion of the reported results for analytical data for soil (Attachment A8), particularly for organic compounds, are qualified as non-detect (U), or estimated below Reporting Limits (UJ). Please explain how these data were used in the HHRA in selection of COPCs, specifically whether "all chemicals detected" (Section A4.4, page A-14) refers only to detected COPCs or detected and estimated (i.e., qualified J).	<ul style="list-style-type: none"> Please refer to the response to DTSC (Polisini) specific comment 2. Estimated (J-qualified) concentrations were included in the data set.
5.	A-12	HERD defers to the DTSC Geological Services Unit (GSU) regarding hydrogeological consequences of the extrapolation of A-aquifer plume boundaries to the B-aquifer "Although contaminant plumes have not been identified in the B-aquifer at Parcel B" (Section 4.3.2, page A-12; and Attachment A4). For the HHRA and ERA, please demonstrate that the highest detected B-aquifer groundwater concentrations are contained within these hypothetical groundwater plumes.	<ul style="list-style-type: none"> Please see the discussion provided in Section A4.3.2. All chemicals detected in the B-aquifer were evaluated in the HHRA, even if the highest measured concentrations were not associated with sample locations contained within the extrapolated groundwater plume boundaries. Chemicals associated with samples located outside of the extrapolated plume boundaries were evaluated in the risk assessment for non-plume exposure areas.
6.	A-18	Only "detected concentrations" were used to develop the groundwater Exposure Point Concentration (EPC) (Section 5.1.2, page A-18) and samples reported as non-detect (i.e., U-qualified) were not used. The text description of samples used for the groundwater EPC does not make clear whether samples reported as estimated (i.e., J-qualified) or estimated below Reporting Limit (i.e., UJ-qualified) were used in the calculation. Please state more explicitly the values used to calculate the 95UCL for groundwater.	<ul style="list-style-type: none"> Please refer to the response to DTSC (Polisini) specific comment 2.

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7.	A-21	<p>The exposure model (VDEQ, 2005) used for the construction worker in a trench scenario (Section A5.1.3.5, page A-21; Attachment A5) was checked against the cited reference (http://www.deq.state.va.us/vrprisk/raguide.html). Formulae presented (Attachment 5) are those in the cited reference and the description as a box model with dispersion into the above-trench air is accurate. However, as noted (Attachment A) the ratio of the trench width (8 feet; Attachment A5, page A5-2) to the trench depth (9.76 feet; Attachment A5, page A5-2) is less than 1. The Virginia guidance recommends an Air Change per Hour (ACH) rate of 2 when this ratio is less than or equal to 1 (VDEQ, Section 3.2.2.1) and greater ACH based on the ratio of trench depth to average wind speed if the ratio of the trench width to the trench depth is greater than 1. The Parcel B calculations use the latter ACH method even though the width to depth is less than one (Attachment A5, page A5-2). Based on the average San Francisco wind velocity the ACH for Parcel B of 100 is used for the construction trench worker inhalation exposure calculations. Use of the ACH rate of 2, per the VDEQ guidance document, would raise the construction worker in trench exposure by a factor of 50. Incremental cancer risk and/or hazard via the inhalation pathway for this scenario would be elevated by the same factor of 50. The inhalation exposure for the construction worker in a trench scenario should be recalculated using the ACH of 2.</p>	<ul style="list-style-type: none"> Attachment A5 of the HHRA (Groundwater-to-Outdoor Air Model for Construction Worker Trench Exposure) will be revised to clarify that the aspect ratio (that is, the ratio of trench width to depth) for construction trenches at Parcel B is expected to be at least 1 or greater than 1. Specific information from 340 excavations (more than 40,000 linear feet) conducted at Parcels B and D support this observation. Data from these excavations indicate that, for trenches less than 4 feet deep, the aspect ratio was approximately 1. For trenches between 4 and 6 feet deep, the aspect ratio was approximately 1.3. For trenches greater than 6 feet deep, the aspect ratio was approximately 1.5. These data show that the assumption of 100 for the trench ACH is appropriate and conservative, as this ACH is less than the VDEQ-recommended ACH of 360 for trenches with an aspect ratio greater than 1.
8.	A-22 & A-23	<p>Exposure parameters (Section A5.2, pages A-22 and A-23; Tables A-4 through A-9) were checked and are the parameters required by Federal or California guidance documents or are reasonable values which appear to be health protective with the following two exceptions:</p> <ol style="list-style-type: none"> The Recreational Use inhalation rate of 0.83 m³/hr, based on residential rate (Table A-6), is less than the probable inhalation rate for play or more strenuous activity. Even though the Recreational Use Exposure Time (ER) of 2.5 hours per day and the Exposure Frequency (EF) of 250 days/year most likely 	<ul style="list-style-type: none"> An inhalation rate of 0.83 m³/hr was used to evaluate inhalation exposures for adult recreational receptors in the HHRA. This inhalation rate was agreed during a meeting with the BCT in March 2004 as a conservative approach. The uncertainty analysis of the HHRA (Section A9.0) will be revised to include a discussion regarding the potential for underestimating construction worker risks and hazards associated with use of an exposed skin surface area for groundwater contact of 2,370 cm²/day, compared with use of a skin surface area consistent with that used to evaluate soil exposures. Other assumptions used to evaluate risks and hazards for the groundwater dermal contact pathway for the construction worker will also be discussed. The assumptions for dermal contact with

TABLE 3: DRAFT RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL, HUMAN AND ECOLOGICAL RISK DIVISION, ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

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		<p>contribute to an upper bound estimate of inhalation exposure for the recreational user, an elevated recreational user inhalation rate on the order of 2.5 m³/hr should be used. This recommendation is based on the construction worker elevated intake rate of 20 m³/8 hour work period.</p> <p>b. Skin Surface Area (SA) for the construction worker dermal contact with soil pathway is 5700 cm² (Table A-5) based on DTSC/HERD guidance. The SA for the construction worker dermal contact with groundwater should be the same value rather than the 2370 cm² proposed (Table A-8).</p>	<p>groundwater are conservative (8 hours per day, 250 days per year for 1 year), and when compounded in the calculation of risks/hazards, are unlikely to result in an underestimate of potential risks for this scenario.</p>
9.	A-29	<p>Some of the U.S. EPA Region IX Tap Water Preliminary Remediation Goals (PRGs) and groundwater concentrations for the vapor intrusion pathway were recalculated to use the same toxicity values (CSFs and RfDs) used throughout the HHRA (Section A7.2, page A-29). Health-based calculation of media concentrations should not be referred to as U.S. EPA Region IX PRGs. Please indicate in the relevant table (Table A-13) those values which are health-based media concentrations rather than indicate that U.S. EPA Region IX PRGs and vapor intrusion groundwater concentrations were recalculated as a column heading.</p>	<ul style="list-style-type: none"> The nomenclature used in text and tables of the HHRA to refer to the recalculated EPA PRGs and vapor intrusion screening levels will be revised so that these concentrations are referred to as health-based media concentrations. Appropriate changes will be made in Appendix A.
10.	A-30	<p>As noted in the text (Section A7.3, page A-30), DTSC considers an incremental cancer risk of 1x10⁻⁶ as the <i>de minimis</i> level above which risk management evaluation of remedial alternatives should be performed. Residential or industrial grid blocks which exceed this level must be identified in the figures and tables of the risk characterization portion of the HHRA (Section A8.0), rather than arbitrarily chose 1x10⁻⁵ as the carcinogenic threshold. In fact, Redevelopment Blocks which exceed the 1x10⁻⁶ cancer risk are already identified (Section A8.0, page A-31).</p>	<ul style="list-style-type: none"> The HHRA consistently discusses use of 10⁻⁶ as the cancer risk threshold. The HHRA does not contain discussion of use of 10⁻⁵ as an alternative risk threshold. No revisions to the report are proposed from this comment.

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11.	A-32 & A-37	<p>There appears to be no clear reference to any presentation of the risk and/or hazard from the summed exposure to contaminants in soil and groundwater. Attachment A-1 and A-2 present the risk and hazard from soil and Attachment A-3 presents the risk and hazard estimates for groundwater (Section A8.0, page A-32). The table headings and figure legends for in each of these sections refer either to soil alone or groundwater alone. The risk characterization summary for the residential use scenario (Section A8.2, page A-37) contains sections for (1) Soil – Total Risk (Section A8.2.1) from surface soil and subsurface soil; (2) Soil – Incremental Risk (Section A8.2.2) from surface soil and subsurface soil; and, (3) Groundwater (Section A8.2.3) from A-aquifer vapor intrusion and B-aquifer residential use. No presentation is made of the summed soil and groundwater risk and/or hazard. Please amend the text to clearly present the cancer risk and/or non-cancer hazard associated with the sum of soil and groundwater exposures and indicate the table, tables and figures which present the details of the exposure via all exposure pathways pertinent to each exposure scenario.</p>	<ul style="list-style-type: none"> • The methodology agreed to between the Navy and the BCT (October 2004) for the groundwater HHRA does not include presentation of cumulative risks for exposure to both soil and groundwater. Rather, as provided in Appendix A of the TMSRA, risks and segregated hazard indices are presented separately for each exposure medium.
12.	3-5 & 2-19	<p>Mercury is listed as a Contaminant of Concern (COC) in subsurface soils for the residential exposure scenario (Section 3.1.3, page 3-5). An EPA oral Reference Dose (RfD) is specified for mercury, while a CalEPA inhalation Reference Doses (RfD) is listed (Table A-12). The inhalation pathway is evaluated by modeling as no air samples were taken. A Volatilization Factors (VF) attributed to the U.S. EPA (EPA Region 9 PRG Tables) is used for 'volatile' COCs to estimate air concentrations. No VF is listed for mercury (Table A-2). Mercury in groundwater is listed as Non-Volatile (NV) (Table A-13). Inhalation hazard for mercury is listed as 0% where the other exposure pathways for mercury sum to 100% (Table 3-6 and Table A-18).</p> <p>Mercury groundwater concentrations range up to 2.8 µg/L (Section 2.3.2, page 2-19). A simple Johnson and Ettinger screen of indoor air mercury concentrations using this mercury groundwater concentration at 3 meter depth and the sand soil type for overlying</p>	<ul style="list-style-type: none"> • Please refer to the response to EPA specific comment 21 regarding evaluation of vapor inhalation exposure to mercury in groundwater. • Please refer to the response to DTSC (Lanphar) specific comment 26 regarding evaluation of ambient air and vapor inhalation exposure to mercury in soil.

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		<p>soil generates a Hazard Quotient (HQ) of 2.3E+00. Soil confirmation samples range from 0.2 mg/kg to 90 mg/kg (Section 2.3.2, page 2-19) at excavation EE-05. A soil mercury concentration of 40 mg/kg at 3 meter depth with no overlying groundwater and the sand soil type generates a similar HQ of 2.8E+00.</p> <p>It appears that the inhalation pathway is not evaluated for mercury in Parcel B soil or groundwater. HERD recommends that the Navy supply an evaluation of the potential human health hazard for subsurface soil and/or groundwater mercury as part of the Technical Memorandum.</p>	
Specific Comments for the Ecological Risk Assessment			
13.	B-5	Direct exposure of secondary consumers to sediment-associated contaminants is not presented as a significant exposure pathway in the Conceptual Site Model (CSM) (Figure B-3). The figure should indicate this is a significant exposure pathway to account for the estimation of intake via incidental sediment ingestion (Section B2.1.3, page B-5; Table B-10 through B-14) for vertebrate receptors.	<ul style="list-style-type: none"> Figure B-3 will be revised to indicate direct exposure to sediment-associated contaminants is a significant exposure pathway. On the figure, the pathway will be indicated as a solid line, rather than a dashed line.
14.	B-10	A range of adverse responses to sediment concentration occurs (Long, et al., 1998) between the National Oceanic and Atmospheric Administration (NOAA) Effects Range-Low (ER-L) and Effects Range-Media (ER-M). Parcel B intertidal sediment concentrations should be compared to both the ER-M and ER-L during the selection of Contaminants of Potential Ecological Concern (COPEC) (Section B2.3.1, page B-10; Table B-4).	<ul style="list-style-type: none"> The screening level ecological risk assessment identified the primary risk drivers (chemicals that posed the greatest risk to ecological receptors) at the site using a comparison to ER-M values. Although concentrations between the ER-L and ER-M may occasionally result in adverse biological effects, concentrations above the ER-M offer a greater probability that adverse biological effects will occur (Long and others 1995). Nevertheless, the remediation alternative proposed for the shoreline (revetment) will be uniformly applied to the entire shoreline. Consequently, the remediation will still be protective of ecological receptors, even if comparison to ER-L values indicated one or more additional COPECs. No change to the report is proposed from this comment.

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15.	B-18 & B-19	The text cites an earlier version of the method for calculating food intake rates (Nagy, et al., 1999) cited (Section B4.1.3, page B-18). The more recent method (Nagy, 2001) for estimating food intake rates for vertebrate receptors is used and presented in tables (e.g., Section B4.2.1, page B-19). Please correct the text citation.	<ul style="list-style-type: none"> The citation will be revised as requested.
16.	B-18 & B-51	Bioaccumulation Factors (BAFs), from the <i>Macoma nasuta</i> laboratory sediment exposure testing previously performed for HPSY Parcel F, were used to estimate the shoreline prey item tissue concentrations for the Parcel B ERA (Section B4.1.4, page B-18). BAFs, which varied from the laboratory-derived BAFs, were also developed from field collected tissues in the Parcel F ERA (Section B5.2.4.1, page B-51). The most protective Parcel F BAF should be used to estimate shoreline tissue concentrations for the Parcel B ERA.	<ul style="list-style-type: none"> The Parcel F validation study concluded that depurated <i>M. nasuta</i> from laboratory exposure testing was a reasonable surrogate for field-collected bivalves because there was a close correlation between tissue concentrations in laboratory test organisms and field-collected bivalves. The Parcel F validation study also concluded that, in South Basin sediments, depurated polychaete tissue reflected lower uptake on a normalized lipid basis than either amphipods or bivalves. The BAFs used in the assessment for Parcel B are protective. No change to the report is proposed from this comment.
17.	B-33	Parcel B sediment concentrations exceed all the available San Francisco Bay ambient sediment concentrations (Section B5.1.1.2, page B-33) except for several individual Polycyclic Aromatic Hydrocarbon (PAHs) concentrations. But, Low molecular weight PAHs (LMWPAHs) and High molecular weight PAHs (HMWPAHs), as groups of PAHs, exceed the San Francisco Bay ambient sediment concentrations (SFRWQCB, 1998). This is to be expected in a comparison of central-bay sediment to near shore sediment, but should be considered during evaluation of any Parcel B sediment remedial alternatives.	<ul style="list-style-type: none"> Comment acknowledged. Total high molecular weight polynuclear aromatic hydrocarbon (HMW PAH) and low molecular weight PAH (LMW PAH) concentrations exceeded the San Francisco Bay ambient concentrations; therefore, none of these chemicals were eliminated as COPECs based on the ambient screen (Section B5.1.1.2). No change to the report is proposed from this comment.
18.	B-34	Parcel B intertidal sediment concentrations should be compared to both the ER-L and ER-M during the refinement of COPECs (Section B5.1.2, page B-34; Table B-19) for benthic invertebrates. COPECs which are a significant fraction of the ER-M concentration should be carried forward with the refined COPECs. This comparison would result in only a few changes to the list of refined COPECs (e.g., zinc in surface sediments; $HQ_{ER-M}=0.85$ and Total HMW PAHs in subsurface sediments; $HQ_{ER-M}=0.91$).	<ul style="list-style-type: none"> Please refer to the response to DTSC (Polisini) specific comment 14.

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19.	B-36	The discussion of groundwater COPECs with HQ values in excess of 1 (Section B5.1.2.3, page B-36) discounts several COPECs because of low frequency of detection and the fact that the HQ for samples other than one or a few that exceed the groundwater screening value is less than 1. The HQ for the groundwater samples, other than those exceeding the screening value, must be supplied rather than stating that "...refined HQs were less than 1".	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 40.
20.	B-36	Several of the groundwater samples which exceed the screening concentration were collected during the September 2004 sampling (Section B5.1.2.3, page B-36). Field collection notes should be reviewed to determine whether there is further information to add to the COPEC refinement process and possibly include these COPECs with the list of refined COPECs.	<ul style="list-style-type: none"> The SLERA used validated data only. The validation process considers uncertainties in the data and applies appropriate qualifiers to the data. The uncertainty evaluation in Section B5.2 addresses these uncertainties. Field notes supplement the assessment but do not directly affect the process for selection of COPECs. Furthermore, the data set for groundwater includes the 12 most recent sampling events; consequently, data from samples collected during one event are not likely to have a great effect on the overall results.
21.	B-36	HERD considers the field collected tissue, while representing a single collection effort, a valid representation of the Subarea-wide polychaete tissue concentration and potential exposure concentration. Please summarize in this section of the Parcel B document the results of the preliminary study which indicate that field-collected samples may "overestimate concentrations in polychaete tissue" (Section B5.2.4.1, page B-36).	<ul style="list-style-type: none"> The Parcel F validation study suggested that body burdens measured in the field-collected polychaetes were greater than body burdens measured in laboratory exposed <i>Macoma nasuta</i>. The validation study stated that field-collected bivalves were likely the result of COPECs sorbed to sediment in the guts and not a higher uptake rate into tissue. To support this hypothesis, the Parcel F validation study cited a study conducted in South Basin in 2001 and 2002 (USACE 2002). This study developed biota-sediment accumulation factors (BSAFs) for polychaetes and amphipods based on laboratory-controlled studies using South Basin sediments and depurated test organisms. BSAFs for PCBs based on depurated <i>Neanthes</i> ranged from 0.155 to 0.181, which were lower than BSAFs developed using <i>Leptocheirus</i> (an amphipod) (BSAFs ranging from 0.386 to 1.334). The BSAFs for <i>Neanthes</i> were also lower than BSAFs developed using the depurated <i>M. nasuta</i> data collected in South Basin for the validation study (0.418 for stations with sediment concentrations less than 2,000 parts per billion PCBs). Therefore, in South Basin sediments, depurated polychaete tissue reflected lower uptake on a normalized lipid basis than either amphipods or bivalve. This information will be incorporated into the discussion in Section B5.2.4.1.

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22.	B-54	HERD agrees with the conclusion that ecological hazard from several contaminants in Parcel B sediments and groundwater cannot be ruled out (Section B5.3, page B-54).	<ul style="list-style-type: none"> Comment acknowledged; no response necessary.
Conclusions			
I.	---	<p>Several HHRA methodological issues require resolution:</p> <ol style="list-style-type: none"> Parcel B risk estimates should include risk from both chemical exposure and exposure to radioisotopes as the basis for risk management decisions; U.S. EPA ProUCL or some statistical methodologies associated with ProUCL should be considered for developing the Exposure Point Concentration; Use of the Virginia Department of Environmental Quality (VDEQ) trench inhalation model should follow VDEQ guidance on the Air Change per Hour (ACH) rate; Recreational user inhalation rates should be adjusted to a higher value and the construction worker skin Surface Area (SA) should be consistent for soil exposure and groundwater exposure; and, A summed risk and/or hazard estimate must be presented for exposure to both soil and water. <p>HERD recommends some mechanism be put in place, for Parcel B Redevelopment Blocks determined to be suitable only for commercial/industrial uses, to limit future use to commercial/industrial use. Some type of buffer zone (i.e., offset) might be necessary between commercial/industrial use Redevelopment Blocks and mixed use Redevelopment Blocks.</p> <p>Evaluation of sediment Contaminants of Potential Ecological Concern (COPECs) for benthic invertebrate should not be based solely on the Effects Range-Median (ER-M), but should also consider the Effects Range-Low (ER-L) when refining the list of</p>	<ul style="list-style-type: none"> (a) Please refer to the response to DTSC (Polisini) specific comment 1. (b) Because of the large number of exposure areas (grids) and scenarios evaluated in the HHRA for soil, use of EPA's ProUCL software for developing EPCs is impractical for the evaluation of soil risks. The methodology used in the HHRA to calculate EPCs for soil is consistent with the methods provided in the previous HHRA for Parcel B (<i>Parcel B Human Health Risk Assessment Methodology Technical Memorandum</i>, Tetra Tech 2003a). ProUCL was used to calculate EPCs in the HHRA for groundwater (see Section A5.1.2 of Appendix A of the TMSRA); also, please refer to the response to EPA specific comment 2 on Appendix A. (c) Please refer to the response to DTSC (Polisini) specific comment 7. (d) Please refer to the response to DTSC (Polisini) specific comment 8. (e) Please refer to the response to DTSC (Polisini) specific comment 11. Mechanisms for future institutional controls are being prepared collaboratively among the Navy and the regulatory agencies. Please refer to the response to DTSC (Polisini) specific comment 14 concerning ER-M and ER-L values. Please refer to the response to DTSC (Polisini) specific comment 21 on field-collected invertebrate tissue.

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		<p>ecological risk drivers.</p> <p>HERD considers the field collected invertebrate tissue previously collected at Hunters Point Shipyard a valid single-sampling event determination of the Parcel F Subarea-wide invertebrate tissue concentrations. The potential ecological hazard associated with these field-collected tissue concentrations should be presented in addition to those developed from the laboratory-exposed <i>Macoma nasuta</i> tissues.</p> <p>Once these Specific Comments are addressed this Technical Memorandum will furnish appropriate revisions of the HHRA and a shoreline ERA sufficient to allow evaluation of a revision to the Remedial Action Plan/Record of Decision (RAP/ROD).</p>	

TABLE 4: DRAFT RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the San Francisco Bay Regional Water Quality Control Board (Water Board) on the “Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated March 28, 2006. Comments were submitted by James Ponton (Water Board) on June 15, 2006. Throughout this table, *italicized* text represents proposed additions to the TMSRA and ~~strikeout~~ text indicates locations of proposed deletions. These responses were submitted on December 8, 2006 and discussed with the Water Board during meetings on January 9 and 23, 2007. Additional information related to a response as a result of further discussions is identified in this table as “**Follow-up**” at the end of a response. Throughout this table, references to page, section, table, and figure numbers pertain to the draft TMSRA, even though some of these numbers have changed in the draft final TMSRA.

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General Comments			
1.	---	<p>No. 1, Installation Restoration (IR) Site 26: The continued monitoring of the IR-26 mercury plume, without source control/removal is unacceptable. Our reasons include:</p> <p>(a) High levels of mercury in the San Francisco Bay (the Bay) are impairing its beneficial uses, which include sport fishing, wildlife habitat, and preservation of rare and endangered species;</p> <p>(b) Groundwater data collected from well IR26MW47A demonstrates a consistent and ongoing source of mercury to groundwater from excavation area EE-05. Confirmation samples taken at EE-05 document that up to 90 milligrams per kilogram (mg/kg) mercury in soil remains. These high mercury soil concentrations have impacted groundwater;</p> <p>(c) Well IR26MW47A which monitors the mercury plume sits within 50 feet of the shore, experiences tidal influence and is in communication with the Bay;</p> <p>(d) The TMSRA concludes that mercury in groundwater poses an ongoing risk to ecological receptors;</p> <p>(e) Continued monitoring does not satisfy the groundwater remediation goal presented in the TMSRA that includes “preventing and minimizing migration of contaminated A-aquifer groundwater above remediation goals to the surface water of San Francisco Bay;”</p>	<ul style="list-style-type: none"> • (a) No response necessary. • (b) Consistent detections of mercury have been observed in samples collected from well IR26MW47A. Bottom composite confirmation soil samples collected at Excavation EE-05 indicate concentrations as high as 90 mg/kg remain in place. The Navy agrees that remaining mercury in soil beneath Excavation EE-05 is a probable source of mercury in groundwater in this area. • (c) The Navy agrees that it is likely that well IR26MW47A experiences tidal influence. • (d) No response necessary. • (e) The Navy agrees that monitoring alone does not satisfy the remediation goal for protection of the bay. • (f) The Navy proposes to modify Alternatives S-3, S-4, and S-5 to include a component for the excavation and removal of additional soil beneath Excavation EE-05 to remove potentially remaining mercury source material. In addition, the Navy has installed two new groundwater monitoring wells in the vicinity of well IR26MW47A and will install a third well within the area of

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		<p>(f) Monitored natural recovery for an aquifer in light of an ongoing source area is not a reasonable nor acceptable remediation strategy for groundwater remediation; and,</p> <p>(g) We are unaware of any natural processes that will convert mercury to a less toxic and less mobile form so as to prevent continued discharge/impact to the Bay and natural recovery of the A-zone aquifer.</p>	<p>Excavation EE-05 after the final remedy has been selected and the mercury source removal completed.</p> <ul style="list-style-type: none"> (g) Changes in pH and oxidation-reduction potential in natural waters can favor the precipitation of dissolved mercury; however, such changes have not been observed in groundwater at well IR26MW47A. However, natural sorptive processes are effective in removing mercury from groundwater. Please also refer to the responses to EPA specific comment 61 and DTSC (Lanphar) specific comment 58.
2.	---	<p><u>No. 2, Groundwater Evaluation Criteria:</u> The TMSRA does not include a screening of near-shore groundwater data against applicable water quality criteria for human consumption of aquatic organisms, an approach that we have strongly advocated in past correspondence, meetings, etc.</p> <p>Although we are pleased that Table B-5 (Appendix B, Groundwater Screening Criteria) includes Basin Plan, CTR and National Recommended Water Quality, and National Ambient Water Quality Criteria) includes an evaluation of surface water criteria, the TMSRA is silent with respect to the risks posed to humans who consume aquatic organisms that grow and may be harvested from the Parcel B inter-tidal area.</p> <p>Over the past several years, we have requested that the Navy screen their tidally-influenced groundwater monitoring results against applicable aquatic toxicity criteria for the protection of (1) aquatic saltwater life, or (2) human receptors who consume fish and shellfish. Recommended toxicity criteria included the published regulatory standards, goals and guidance established by the Water Board in the "Water Quality Control Plan, San Francisco Bay Region (Water Board 2005), and a Compilation of Water Quality Goals" (Water Board 2000), the U.S. Environmental Protection Agency (EPA) California Toxics Rule (EPA 2000) and National Recommended Water Quality Criteria (EPA 2002). After the initial screen, we have advocated that any final assessment of remedial alternatives/activities would be evaluated using groundwater fate and transport factors.</p> <p>Our recommended approach is consistent with the approach applied at Treasure</p>	<ul style="list-style-type: none"> Potential human health risks from shellfish consumption were evaluated in the Parcel F validation study (Battelle and others 2005). For the purpose of the assessment, future residents were assumed to harvest and consume shellfish from the intertidal areas of HPS. The evaluation determined that cumulative health risks to future residents are consistent with or below reference levels at Area I (India Basin) and Area III (Pt. Avisadero). A discussion of trigger levels and comparison of groundwater to surface water quality criteria, similar to that prepared for the Parcel D FS, will be added as Appendix I to the TMSRA. Issues related to the response to the Water Board's letter of March 2006 have been discussed with the BCT (related to the trigger levels developed for the Parcel D FS) and will be addressed by the new Appendix I in the TMSRA.

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		<p>Island Shipyard, San Francisco. We have had much discussion on this strategy and have summarized our discussions in a March 2006 letter written by the Water Board staff (i.e., Groundwater Evaluation Criteria, Points of Compliance, and Next Steps, Hunters Point Shipyard, San Francisco, dated March 16, 2006). For the record, a copy of our March 26 position letter (Attachment I) is incorporated into this comment letter.</p> <p>Lastly, to date we have not received a formal Navy response to our March 2006 letter although the Navy has indicated that their response will be forthcoming (by June 2006 BCT meeting).</p>	
3.	---	<p><u>No. 3, Surface Water and Parcel B Boundary:</u> The TMSRA's statement that "there is no surface water on HPS Parcel B" seems contradicted by the scoping level ecological risk assessment (SLERA) provided as Appendix B. The SLERA's focus is on the inter-tidal zone of the Parcel B shoreline, benthic invertebrates that inhabit this range, and the adjacent offshore area associated with groundwater-surface water interaction. In addition, the claim that "groundwater may discharge to the bay, however any groundwater discharge occurs offsite" is unsupported by site specific data/facts.</p> <p>We believe that near-shore groundwater, particularly in the areas of IR-07 and IR-26 (i.e., open shoreline areas that are not defined by engineered concrete sea walls) clearly communicates and exchanges with/into Parcel B sediments and adjacent surface water.</p>	<ul style="list-style-type: none"> The Navy continues to work with the regulatory agencies to define areas that are appropriately placed in onshore parcels (such as Parcel B) or in offshore Parcel F. The statement that "there is no surface water on HPS Parcel B" should be qualified to indicate there no surface water <i>in upland areas</i> at Parcel B or that surface water is a concern for Parcel B <i>only in the shoreline areas</i>. Text in the TMSRA will be modified accordingly.
4.	---	<p><u>No. 4, Surface Water ARARs:</u> As noted in Comment No. 3, above, surface water is not being evaluated as part of the TMSRA. Given that Parcel B is located along the edge of San Francisco Bay, we believe that the discharge of contaminants from the flow of groundwater (traveling directly to the Bay and/or through the existing or future storm drain/utility network) is a concern at Parcel B.</p> <p>The Final Feasibility Study for IR Site 28, Todd Shipyards, Alameda, is located in a similar setting (i.e., adjacent to the Oakland inner harbor), includes/evaluates federal and state ARARs for surface water and proposes a remedial action objective for arsenic in groundwater on numerical water quality criteria promulgated in the California Toxics Rule (CTR).</p>	<ul style="list-style-type: none"> Requirements of the California Toxics Rule (CTR) will be identified as potential federal chemical-specific ARARs and Table 3-3 of the Basin Plan as potential state chemical-specific ARARs for the surface water beyond the interface of the A-aquifer groundwater and the bay. Appropriate changes will be made to Section 4.2 and Appendix C. The following text will be added as Section 4.2.1.3, titled "Surface Water." <i>"There is no surface water body on Parcel B. Groundwater at Parcel B has the potential to discharge to the bay. The Navy has identified the substantive provisions of the California Toxics Rule (CTR) as potential federal chemical-specific ARARs and</i>

TABLE 4: DRAFT RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

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		Another example where the human consumption of organisms pathway was evaluated is found at Alameda Point, IR Site 1 (Draft Proposed Plan for IR Site 1 1943-1956 Disposal Area, Former NAS Alameda, dated May 16, 2006). The RAOs for groundwater proposed at Site 1 are based on human health criteria (for consumption of organisms only) contained in the CTR.	<i>Table 3-3 as potential state chemical-specific ARARs for surface water beyond the interface of the A-aquifer groundwater and the bay. In this TMSRA, the Navy is evaluating groundwater monitoring as a component of Alternatives GW-2, GW-3A, and GW-3B. This will allow the Navy to monitor any direct release of contamination to the bay."</i>
5.	---	<p><u>No. 5, Groundwater Chemicals of Potential Environmental Concern (COPECs):</u> The TMSRA/SLERA does not provide sufficient supporting data to eliminate from further consideration the reported detections of copper, lead, mercury, selenium, zinc, alpha-chlordane, endrin aldehyde, gamma-chlordane, and heptachlor as COPECs for groundwater.</p> <p>As compared to the Parcel B hexavalent chromium (chromium IV) study (documented in Appendix H of TMSRA) which was aimed at identifying the nature and extent of chromium IV in the vicinity of IR10MW12A, the COPEC discussion for groundwater falls short, providing no context (i.e., analytic data tables including applicable screening criteria, trend curves, well completion specifications, etc.) for not retaining all but one (mercury) COPEC.</p> <p>Without a more rigorous evaluation and presentation of data, we do not support dismissing from further consideration the COPECs identified in the TMSRA/SLERA.</p>	<ul style="list-style-type: none"> • Please refer to the response to DTSC (Lanphar) specific comment 40.
6.	---	<p><u>No. 6, Remedial Alternatives evaluated for Groundwater:</u> The Navy's strategy for groundwater remedial alternatives is to "eliminate complete exposure pathways to the potential receptors and to monitor the known affected areas while the aquifer recovers" does very little to control non-VOC source areas and minimize chemical (i.e., arsenic, copper, lead, mercury, selenium, zinc, alpha-chlordane, endrin aldehyde, gamma-chlordane and heptachlor) loading to the Bay.</p> <p>While eliminating/minimizing human exposure to groundwater on the landward portion of Parcel B can be achieved through adopting, implementing and enforcing institutional controls preventing groundwater use and exposure, we believe that the retained remedial alternative(s) for groundwater (i.e., in-situ treatment, coupled with reduced groundwater monitoring and institutional</p>	<ul style="list-style-type: none"> • Please refer to the responses to Water Board general comments 1 and 5 and DTSC (Lanphar) specific comment 40.

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		controls) do little to remediate and control, for example, the mercury plume reported in IR-26.	
Specific Comments			
1.	---	<u>No. 1, Parcel B Boundary</u> : Please provide a clear description of what portions of land and shoreline constitute Parcel B and that are included in the TMSRA. We note that the SLERA and its accompanying figures include the offshore portions of Parcel B/F in its ecological evaluation.	<ul style="list-style-type: none"> The SLERA is based on sediment samples collected from the shoreline at Parcel B and does not consider any offshore areas in its evaluation. Please also refer to the response to Water Board general comment 3.
2.	---	<u>No. 2, Appendix B (SLERA), TMSRA for Parcel B, Section B2.1.2</u> : We do not agree with the statement that the ecological point of exposure for groundwater at Parcel B is the point where groundwater surfaces and mixes with surface water of the Bay. We believe that fate and transport processes of contaminated groundwater at the Parcel B shoreline include the migration and discharge of contaminated groundwater through sediment resulting in potential exposure to benthic invertebrates to contaminated groundwater and sediment.	<ul style="list-style-type: none"> Mixing of groundwater and surface water is a complex topic that is subject to many variables. However, the SLERA focuses on the shoreline receptors, and therefore, is concerned only with the areas that receptors inhabit where groundwater can directly interact with surface water. This area would include the pore space within the shoreline sediment (habitat of the benthic invertebrate receptors) and the area above the sediment where groundwater mixes with the surface water of the bay (where diving birds, for example, could be exposed). The text of Section B2.1.2 will be revised as follows. "The ecological point of exposure for groundwater at Parcel B is the point includes the areas within the shoreline sediment pore space and the areas where groundwater surfaces and-mixes with surface water of the bay."
3.	---	<u>No. 3, Appendix B (SLERA), TMSRA for Parcel B, Section B5.1.2.3</u> : The SLERA calculated hazard quotients (HQs) of greater than 1.0 for chemicals in groundwater that included arsenic, copper, lead, mercury, selenium, zinc, alpha-chlordane, endrin aldehyde, gamma-chlordane, and heptachlor. With the exception of mercury, none of these chemicals/metals were retained as COPECs for the protection of aquatic life. The reason for dropping these COPECs is rooted, in many instances, in "low or sporadic frequency of detection". As noted in General Comment Nos. 2 and 5, Section B5.1.2.3 is not sufficiently detailed to dismiss from further consideration the COPECs with HQs >1.0 nor has the Water Board and Navy reached consensus on what constitutes applicable screening	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 40.

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		limits/concentrations for groundwater that communicates with the Bay. Revise the TMSRA to include sufficient detail (i.e., trend curves, analytic tables, screening levels, detection limits as compared to screening levels, etc.) to better justify the list of COPECs that will be carried forward.	
4.	ES-7	<u>No. 4, Remedial Action Objectives (RAOs) for Contaminated Groundwater, ES-7 and Section 4.1.2:</u> The RAOs for contaminated groundwater in part include preventing and minimizing migration of contaminated A-aquifer groundwater above remediation goals to the surface water of San Francisco Bay. Expand the RAOs to include the protection of existing beneficial uses of surface water adjacent to Parcel B, including the protection of ecological receptors.	<ul style="list-style-type: none"> This bullet will be revised as follows. “Prevent or minimize migration of contaminated A-aquifer groundwater above remediation goals to the surface water of San Francisco Bay. <i>This RAO is intended to provide protection of the beneficial uses of the bay, including protection of ecological receptors.</i>”
5.	---	<u>No.5, Institutional Controls:</u> Several of the soil, sediment, and groundwater remedial alternatives described in the TMSRA rely in part, on institutional controls to eliminate human exposure to contaminated soil, shoreline sediment, and groundwater. We believe that institutional controls are effective in minimizing exposure only if the controls are implemented, maintained, routinely evaluated and corrected/enforced upon in the event they are breached. Elaborate and specify on who will maintain, evaluate, inspect and correct any identified deficiencies in any ICs adopted for Parcel B once the property is transferred from the Navy to the San Francisco Redevelopment Agency, etc. Further expand on what restrictions will be placed on site dewatering, utility (i.e., storm/sanitary lines, electric, etc.) corridors, structural pilings, etc. that may potentially transverse groundwater plumes, short-circuit the connection of those portions of the contaminated A-zone aquifer with the Bay, cross connect the A-zone with deeper drinking water aquifers bearing zones (B-aquifer and bedrock aquifers), and/or draw contaminated groundwater across the site and onto more relatively clean parcels.	<ul style="list-style-type: none"> The Navy has addressed this concern by adding additional language to the draft TMSRA institutional control process option provisions in Section 4.3.2.1 of the TMSRA to address the Water Board’s preferential pathway concerns. That language has been shared with the Water Board for further refinement, review, and comment. Specific details regarding roles and responsibilities for monitoring, inspection, and enforcement of institutional controls will be established in the land use control (LUC) remedial design/remedial action report as specified in the TMSRA. Please refer to Attachment 2 for more revisions to Section 4.3.2.1.
6.	---	<u>No. 6, Building 142:</u> Building 142 appears on Figure 2-1 but appears to be missing from subsequent figures. Correct the TMSRA figures as appropriate.	<ul style="list-style-type: none"> Building 142 was demolished; demolished buildings are not shown on other figures in the TMSRA. No other corrections to figures are necessary.

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7.	---	<p><u>No.7, Figure 2-4, Site Conceptual Model:</u> Amend Figure 2-4 to:</p> <ul style="list-style-type: none"> • Show (slightly project as needed) monitoring wells IR26MW48 A and – 47A onto Figure 2-4 (Hydro-geological conceptual model); • Depict the tidally influenced zone shown on Figure 2-3 onto the cross sections; and, • Show the A/B aquifers to lend support of the distribution of Bay Mud aquitard and B-aquifer characterization write-up presented on page 2-2. 	<ul style="list-style-type: none"> • Cross section C-C' will be modified to include well IR26MW48A. Well IR26MW47A will not be added to the cross section because very little material was recovered from the boring during well installation and the interpretation of the subsurface units is uncertain. • The tidally influenced zone shown on Figure 2-3 will be projected onto the cross sections of Figure 2-4. • The units corresponding to the A- and B-aquifers will be identified in the legend of Figure 2-4.
8.	---	<p><u>No. 8, Section 2.2.4.3, Beneficial Use of Groundwater:</u> Please correct Section 2.2.4.3 to:</p> <ul style="list-style-type: none"> • Reference the most current Region 2 Water Board Basin Plan; and, • Include a description of all existing and potential beneficial uses for groundwater (i.e., surface water replenishment, etc). 	<ul style="list-style-type: none"> • The text of Section 2.2.4.3 will be modified as follows. “Appendix E contains the complete beneficial use evaluation. <i>The evaluation considers the current Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin (Water Board 2004) which identifies the following existing and potential beneficial uses for groundwater: municipal and domestic water supply, industrial water supply, industrial process water supply, and agricultural water supply.</i>” • Follow-up: The Navy does not consider surface water replenishment to be one of the beneficial uses of groundwater and text describing this beneficial use has not been added to Section 2.2.4.3 and has been deleted from the executive summary and Appendix E.

TABLE 5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from the City and County of San Francisco (the City) on the “Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated March 28, 2006. Comments were submitted by Amy Brownell (City) on June 20, 2006. Throughout this table, *italicized* text represents proposed additions to the TMSRA and ~~strikeout~~ text indicates locations of proposed deletions. These responses were submitted on December 8, 2006 and discussed with the City during meetings on January 9 and 23, 2007. Additional information related to a response as a result of further discussions is identified in this table as “**Follow-up**” at the end of a response. Throughout this table, references to page, section, table, and figure numbers pertain to the draft TMSRA, even though some of these numbers have changed in the draft final TMSRA.

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1.	---	<u>Section 1.2, Future Land Use.</u> In describing land uses potentially associated with mixed-use and research and development areas on Parcel B, the draft TMSRA states that, among other things, such areas “could include upper-story housing . . .” Provided the soil cover is in place and intact, as described elsewhere in these comments, the property should be suitable for any uses that are not expressly prohibited, subject to certain restrictions. Among these allowable uses should be any residential use that does not undermine the integrity of the soil cover, which may include upper-story housing, but may also include residential dwellings at ground level.	<ul style="list-style-type: none"> Based on discussions among legal staff from the Navy and the regulatory agencies, the description of future land use restrictions (described in Section 4.3.2.1) will continue to include language focused upon restricted uses subject to FFA Signatory review and approval, rather than allowable uses subject to FFA Signatory review and approval. Use of property for any form of residence for human habitation would require review and approval by the FFA Signatories in accordance with the “Covenant(s) to Restrict Use of Property”, Quitclaim Deed(s), and the Parcel B RMP. Proposed revised text for Section 4.3.2.1 discussing institutional controls is included as Attachment 2 to these responses. Follow-up: Section 1.3 on future land use was revised to include single-family homes as a potential residential land use.
2.	---	<u>Section 2.3.2 Overview of Groundwater.</u> The IR-10B chromium VI plume is identified by detectable concentrations in one well only. Mercury is also detected in one well only (IR26MW47A), but this detection is not considered as a plume in the TMSRA, and is not included in the development of remedial alternatives. Even if “monitoring only” is selected as the remedial alternative for the mercury, it should be identified as a plume and addressed in Section 5.0: Development and Description of Remedial Alternatives. However, applying a monitoring only alternative to this non-naturally occurring plume may cause it to fail both the regulatory and community acceptance criteria. Consider performing some type of in-situ treatment or periodic removal to reduce the residual concentrations. The extent of impacts to groundwater is relatively limited; therefore only	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 13 concerning plume descriptions. Please refer to the response to Water Board general comment 1 about additional remedial alternatives for mercury at IR-26.

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		nominal effort and resources would be required for a remediation effort.	
3.	---	<p>General Comment on Section 3.0. This section describes many areas of Parcel B with excess cancer risk, noncancer hazards and contaminants above the remediation goals. In Section 5.0, only four areas of Parcel B are recommended for excavation due to exceedance of these criteria. Soil covers are proposed for mitigating exposure to metals in soil that exceed remediation goals, with the exception of lead at two locations. Only two locations with organics are proposed for excavation. See comment to Section 5.2.3 (below), which details the areas where organics and/or lead exceed remediation goals but are not proposed for excavation.</p>	<ul style="list-style-type: none"> Please refer to the response to City comment 30 on Section 5.2.3 below.
4.	---	<p><u>Section 3.1.1 – Exposure Scenarios and Pathways.</u> The human health risk assessment for vapor intrusion from VOCs in groundwater is based on using a ratio of site concentrations to screening levels. The screening levels used were the U.S. EPA Vapor Intrusion Guidance (2002) groundwater screening values, which were apparently modified according to the California toxicity values used elsewhere in the Human Health Risk Assessment (HHRA). The use of screening values to estimate indoor air inhalation risks is an appropriate screening-level method to evaluate potential vapor intrusion, but the screening values used (Table A-13) are very conservative and appear to be about 2 orders of magnitude less than corresponding Environmental Screening Levels San Francisco Bay Regional Water Quality Control Board (SF-RWQCB ESLs) for protection of indoor air (SF-RWQCB, 2005 – Table E-1a). Therefore, groundwater vapor intrusion risks in the HHRA are more conservative than those that would be calculated using the ESLs, which is the most common approach, used in other screening-level risk evaluations in the San Francisco Bay Area. The risk evaluation includes the identification of remediation goals for volatile organic compounds (VOCs) (Table 3-18), which are based on a combination of risk-based concentrations (RBCs) and laboratory practical quantitation limits (PQLs). For VOCs, the groundwater risk-based concentrations developed for Parcel B were based on the conservative HHRA vapor intrusion calculations. In many cases, the RBC was lower than the PQL, which resulted in the remediation goal being set to the PQL. More site-specific RBCs or RBCs based on a site-specific attenuation of groundwater to indoor air concentrations would result in significantly different RBCs and remediation goals.</p>	<ul style="list-style-type: none"> The use of the EPA (2002) screening levels for vapor intrusion (modified for consistency with the toxicity criteria used elsewhere in the HHRA) to estimate risks from vapor intrusion of groundwater was based on the methodology agreed to between the Navy and BCT (October 2004) for the groundwater HHRA. Section A9.5 of the HHRA provides an evaluation of the differences associated with use of a generic, rather than site-specific, screening level to estimate risks from vapor intrusion. The evaluation showed that use of generic screening levels resulted in an overestimate of potential risks from vapor intrusion by no more than a factor of two, accounting for the site-specific conditions at HPS. Accordingly, the generic groundwater remediation goals developed for Parcel B to address the vapor intrusion pathway are not expected to be overly conservative by more than a factor of two.

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5.	---	Section 3.1.3.1 Total Risk Evaluation. Tetrachloroethene and trichloroethene are included as chemicals of concern in soil based on inhalation of volatile organic compounds to outdoor air. Why wasn't risk from VOCs in soil to indoor air included in the risk estimates for the residential and industrial exposure scenarios? Appendix A, Section 5.1.3 does not include a discussion of this pathway.	<ul style="list-style-type: none"> Please refer to the third bullet in the response to DTSC (Lanphar) specific comment 26 regarding evaluation of vapor intrusion for the unsaturated zone.
6.	---	<p>Section 3.0 Tables and Figures.</p> <ul style="list-style-type: none"> Table 3-11, page 1 of 2 – There is an error in the percent contribution by exposure pathway that starts in the lines of Redevelopment Block 7 and continues for several lines. The percentages add up to more than 100% and that is not possible. Table 3-22, page 3 of 9, Redevelopment Block 3 – In grid number B1230, sample number 0704BC89, the concentration is listed as 174 mg/kg but in Appendix A the concentration is listed as 211 mg/kg. Please correct this discrepancy. Table 3-22 – Incremental Risk: Risk and Hazards Drivers by Planned Reuse and Associated Sampling Locations Exceeding Remediation Goals, Subsurface Soil (0 to 10 feet bgs) - The entry for B3426 (Block 8) is missing from the table. This is one of the areas proposed for excavation (Page 5-6). Figure 2-2: The Excavation Location Map (Figure 2-2) shows several excavation areas which appear to be shown as areas with no data (Figures 3-2 through 3-6) for purposes of HHRA calculations, although Appendix A states that data collected from post-excavation confirmation samples were used. Rather than showing backfilled areas as having no data, we suggest that data from backfill material as well as post-excavation confirmation samples be included in risk calculations to provide a more realistic risk. RME - Almost all of the Section 3.0 tables include a reference to the Reasonable Maximum Exposure (RME) for the calculation of intake and associated risks and hazards. Although RME is defined in 	<ul style="list-style-type: none"> Table 3-11 will be revised to correct the percent contribution errors. The discrepancy between the result shown for lead in grid B1230 Table 3-22 and the result shown in Attachment A8 resulted from the methodology used for duplicate samples in the HHRA. As discussed in Section A4.2.1 of the HHRA, duplicate samples are averaged in the HHRA for purposes of calculating exposure point concentrations (EPC). The concentration of 174 mg/kg shown in Table 3-22 is based on the average of the duplicate results for sample location 0704BC89: 211 mg/kg and 137 mg/kg. Attachment A8 provides both of these results. Follow-up: Tables 3-21 and 3-22 were revised to include all discrete sample results that exceed remediation goals for lead. For duplicate pair samples, each discrete result of the duplicate pair that exceeds the remediation goal for lead was included on Tables 3-21 and 3-22. This revision only pertains to lead as a COC; discrete results that exceed remediation goals for the other COCs (other than lead) are already listed in Tables 3-21 and 3-22. Tables 3-21 and 3-22 will be revised to list discrete sample results for samples with duplicates (that is, both the original result and the duplicate result will be presented). Footnotes will be added to these tables to identify the duplicate results. Follow-up: Duplicate results, when greater than the remediation goal, were added to Tables 3-21 and 3-22. Duplicate samples are readily identified by the repetition of the sampling information (same sample name and same sample depth) and footnotes are not necessary and were not added. Table 3-22 will be revised to include the sample result for lead in grid B3426. Figure 2-2 will not be revised. Excavation backfill material is not

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		<p>Appendix A, a definition of RME should be inserted into Section 3.0 to explain the tables as well as on the tables themselves.</p> <ul style="list-style-type: none"> Construction Worker Risks – The assumed exposure duration for the construction worker risk calculations is one year (Table A-4, A-5, A-6 and A-8), which we understand is based on DTSC guidance for modeling construction worker risks. Does the one-year exposure duration and the Hunters Point site-specific 150 by 150 grid model result in a calculated risk that is adequately protective of construction workers for expected construction scenarios at Hunters Point Shipyard? Our understanding is that the build out of Parcel B may continue for 10 years, involving construction worker and soil movement throughout the site. 	<p>considered in the HHRA.</p> <ul style="list-style-type: none"> The text and tables in Section 3.0 will be revised to include an explanation of RME. Follow-up: The explanation in Appendix A is sufficient; Section 3.0 was not revised. According to City’s transmittal letter for these comments, dated June 20, 2006, the City considers the assumptions used to evaluate potential risks to construction workers to be conservative, and that construction workers would not be at risk during normal construction activities. In discussions with the BCT concerning this issue, DTSC staff agreed to investigate the basis for the construction worker exposure parameters to ensure the parameters would be protective of the planned construction activities at Parcel B. Mr. Tom Lanphar, DTSC, consulted DTSC risk assessment staff and confirmed in a meeting with the Navy on July 12, 2006, that the construction worker exposure assumptions would be adequate to address the expected construction scenario at Parcel B.
7.	4-3	<p>Section 4.1.1.2, Page 4-3, Soil RAO for Inhalation of VOCs. With the exception of Alternative S-5, it is unclear how each of the alternatives presented in Section 5.0 address the inhalation of VOCs.</p>	<ul style="list-style-type: none"> Alternatives S-2, S-3, and S-4 address the potential risk from inhalation of VOCs through institutional controls for existing buildings and through engineering controls for future structures. Residential or industrial occupancy of existing buildings will be prohibited where the HHRA concludes there is a potential unacceptable risk. Vapor controls will be required as part of future structures built in all areas of Parcel B. Engineering controls could also be used to retrofit existing buildings so that residential or industrial occupancy would be acceptable. Additional discussion of institutional and engineering controls related to vapor intrusion will be included in Section 4.3.
8.	4-3	<p>Page 4-3 – Methane at Block 3. States “Prevent presence of methane in soil gas above... 5 percent (by volume in air)”. Although the removal action appears warranted, actual identification of the source material in the field may not be achievable. Experience at Mission Bay (San Francisco) indicates that methane concentrations may be highly variable in a small area (e.g., single commercial building footprint) over time, i.e. it may not be there when the same location is re-sampled and/or it may recur later, if the</p>	<ul style="list-style-type: none"> Please refer to the response to EPA specific comment 54.

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		true source material is not identified/identifiable and excavated. Therefore, it may be necessary to monitor several times post-remediation to verify that the source has in fact been removed. If methane recurs, additional excavation may be warranted or a vapor mitigation system (VMS) may be required for any new structure within 100 feet in accordance with current DTSC guidance.	
9.	4-4	<u>Section 4.1.2.1, Page 4-4, Groundwater Plumes and Chemicals of Concern.</u> Since the HHRA did not find unacceptable risk associated with the IR-10B plume, it may not appear to be worth any effort to remediate this plume. However, remedial action may be necessary to gain regulatory and/or community acceptance. The chromium VI plume appears to be relatively confined; therefore, it may be amenable to limited, localized in-situ treatment with an agent that induces the chromium VI to convert to chromium III.	<ul style="list-style-type: none"> Active remediation is not proposed for the IR-10B plume. No change to the table is proposed from this comment.
10.	4-14	<u>Page 4-14 – Treatment of Soil.</u> Suggest rewording as follows: “Treatment – Includes in situ and ex situ treatment of soil to reduce the toxicity (via degradation) and/or volume (via destruction) of the contaminants.” It should also be noted that the reduction of toxicity may be dependent upon driving the chemical reactions to completion, to avoid leaving more-toxic daughter products.	<ul style="list-style-type: none"> The text of Section 4.3.1 will be revised as follows. “Treatment—includes...to reduce the toxicity <i>and volume</i> of the contaminants.”
11.	4-14	<u>Section 4.3.1, Page 4-14, Development of General Response Actions.</u> For both soil and groundwater, ICs including land use restrictions and access restrictions are listed as a General Response Action (GRA). However, none of the cost estimates presented in Appendix D include any funds for installation or maintenance of the access restrictions which would presumably include installation fencing at a minimum, possibly supplemented by additional security measures. Installation of signage and annual drive-by inspections are inadequate “access restrictions” for this site.	<ul style="list-style-type: none"> The cost estimates for the alternatives assume that signs would be sufficient to restrict access. The cost estimates include a land use control remedial design. Appropriate institutional and engineering controls will be evaluated for these alternatives.

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12.	4-14	<p><u>Section 4.3.1, Page 4-14, Development of General Response Actions – Groundwater.</u> The last bullet item for groundwater states, “Containment – Includes installing a slurry wall to control groundwater flow and vapor barriers to prevent vapor intrusion.” Although a slurry wall meets the definition of “containment”, vapor barriers do not. It would be more accurate to instead classify vapor barriers as an “engineering control”, since they do not contain the impacted medium, but rather block an exposure pathway.</p>	<ul style="list-style-type: none"> Vapor controls create a physical barrier to prevent the migration of contaminated vapors to indoor air. Vapor controls can include more than vapor barriers and are considered part of the containment general response action. The text will be revised as follows. “Containment – Includes installing a slurry wall to control groundwater flow and vapor controls barriers to prevent vapor intrusion.”
13.	---	<p><u>Section 4.3.2.1, Evaluation of Applicable Soil Process Options and Section 4.3.2.2, Evaluation of Applicable Groundwater Process Options.</u></p> <p><u>1. Institutional Controls Generally</u></p> <p>We disagree with the statement in the draft TMSRA, as applied to Parcel B, that the purpose of institutional controls is to maintain the integrity of a remedial action until remediation is complete and remedial goals are achieved. (4-15 to 4-16).</p> <p>It is our view that institutional controls are administrative and legal controls that are put in place as part of a remedy on a site after remediation is complete to limit the exposure of future users to contaminants where a site has not been cleaned to unrestricted use standards. On Parcel B, it is our understanding that the specific purpose of the institutional controls is to assure that the site may be reused in a manner that protects future users, as provided for in the City’s 1997 Redevelopment Plan, from exposure to contaminants in excess of remediation goals for the site. Accordingly, the remedy, including the institutional controls, should be considered a permanent remedy; all references to future “cleanup” should be deleted from the TMSRA, and no future environmental characterization of the site should be contemplated.</p> <p><u>2. Soil Cover Generally</u></p> <p>The fundamental principle of the institutional control for the soil cover requirement must be that, provided the cover prohibiting soil exposure is properly constructed and intact, Parcel B will be suitable for the intended land uses. Instead, the institutional control in the draft TMSRA is designed</p>	<ul style="list-style-type: none"> The Navy is continuing to work actively with the BCT and the City to resolve issues related to the content, implementation, and enforcement of institutional controls. City subsection 1. Proposed revised text for Section 4.3.2.1 discussing institutional controls is included as Attachment 2 to these responses. This revised language addresses the City’s concern about limiting exposure to hazardous substances remaining on the property and clarifies that ICs serve both the purpose of protecting the integrity of remedial action and preventing exposure to contaminants left in place. Institutional controls will also prevent exposure where waste has been left in place (for example, IR-07 and IR-18). Also refer to the response to DTSC (Lanphar) specific comment 53. City subsection 2. The proposed land use restrictions are consistent with and support the land uses set forth in the 1997 Redevelopment Plan. The intended land uses may proceed subject to restrictions approved in advance by the FFA Signatories. This will ensure that the intended land uses will be conducted in a manner that will protect human health and the environment. The Navy generally agrees with the statement that proper management of soil and groundwater and the repair or replacement of covers resulting from land-disturbing activities is important. Land-disturbing activities such as grading and trenching will require restrictions to assure proper

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		<p>to only allow for “restricted land uses” if Navy and DTSC approval is obtained prior to construction, and in accordance with a highly problematic process and set of criteria (page 4-17). This structure for the institutional control does not establish that Parcel B will be suitable for its intended reuse following transfer.</p> <p>At the time of the transfer, the soil cover should be in place and the intended land uses should be allowable without any further approvals. At that time, the soil cover should meet all of the specification established for use of the site subject to certain “activity” restrictions, as further described below in these comments. Provided the soil cover is properly in place and intact, the institutional controls should not require the transferee to obtain additional approvals or take further actions to allow for any of the intended land uses. If redevelopment requires land-disturbing activities, these activities should be identified as subject to separate “activity” restrictions that assure proper management of soil and groundwater and the replacement of cover, pursuant to an approved Risk Management Plan, as further discussed in these comments.</p> <p><u>3. Scope of Land Uses Subject to Soil Cover Requirement</u></p> <p>The institutional control language in the draft TMSRA does not include commercial and industrial uses or open space uses among the land uses on Parcel B subject to the soil cover requirement. However, based on our understanding of the draft TMSRA and the accompanying human health risk assessment, commercial and industrial uses and open space uses are among those land uses that would pose an unacceptable risk to human health without soil cover to eliminate the soil exposure pathway. The draft TMSRA should be clear about what land uses are included among the land uses subject to the soil cover requirement on Parcel B and why. For the reasons described in this comment, we have included commercial and industrial and open space uses, as well as all other uses that aren’t expressly prohibited, as uses subject to the cover requirement in the proposed approach to the institutional control set forth below in comment 5 of this section.</p> <p><u>4. Areal Extent of Soil Cover Requirement</u></p>	<p>management of soil and groundwater and replacement or repair of disturbed covers. Also refer to the response to DTSC (Lanphar) specific comment 57.</p> <ul style="list-style-type: none"> • City subsection 3. Institutional controls will apply to industrial and open space land uses, in addition to residential uses. Please refer to the revised discussion of institutional controls presented as Attachment 2. • City subsection 4. Soil cover is proposed for open space areas at IR-07 and IR-18 (Redevelopment Block BOS-1). A figure will be added to the TMSRA to illustrate the proposed locations of various types of covers. Please also refer to the response to EPA specific comment 58. • City subsection 5. Please refer to the response to subsection 1 above and Attachment 2 for discussion of restricted land uses. • Any use of groundwater will be prohibited, just as it currently is in the existing ROD. • Institutional controls will continue to describe restricted uses, not allowable uses. • Please refer to Attachment 2. • City subsection 6. Risk management plan provisions have been included in the revised language in Attachment 2. Please refer to Attachment 2 and to the response to DTSC (Lanphar) specific comment 54. • City subsection 7. Please refer to Attachment 2. • City subsection 8. Operation and maintenance requirements will be contained in the LUC RD. Activities conducted to address O&M requirements (for example, repairing damage from erosion) that are unrelated to institutional controls (such as, RCRA ARARs or engineering control requirements) will not be addressed in the LUC RD. The Navy considers O&M only of the original covers. Oversight of institutional controls to ensure covers are effective is a separate item. The costs of complying with institutional controls that are not directly related to the

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		<p>According to Table 5-1, Major Components of Soil Alternatives by Redevelopment Block, the draft TMSRA does not propose soil cover for portions of Parcel B. While the text does not discuss the rationale for only proposing soil cover in certain areas, it appears that soil cover is only being proposed as the remedy in areas where sufficient sampling was conducted to determine that soils pose an unacceptable risk to human health. Where no soil sampling was conducted or minimal soil sampling was conducted that did not identify human health risks, no risk is assumed and no soil cover is proposed. Instead, soil cover should be proposed for the entirety of Parcel B due to the anticipated risk associated with ambient metals and some organic contaminants in soil, based upon soil sampling that was conducted at the site. The text of the TMSRA should be clear about the areal extent of the soil cover requirement on Parcel B, rather than only having this information summarized in Table 5-1.</p> <p><u>5. Distinguishing Prohibited Land Uses From Land Uses and Activities Subject to Conditions</u></p> <p>The Institutional Controls section should more clearly identify the purpose of the institutional controls on Parcel B and why these particular controls are necessary (e.g., specify the risk and how it is addressed by the control). As we understand the situation on Parcel B, some uses will need to be prohibited, all uses not expressly prohibited will be allowed provided the soil cover is in place and intact, and some activities will be subject to certain site management requirements.</p> <p>We propose the following general approach to the Parcel B institutional controls in lieu of the approach taken in the draft TMSRA.</p> <p><u>Prohibited Uses</u></p> <p>The following uses shall be prohibited at HPS Parcel B:</p> <ul style="list-style-type: none"> a. Growing of vegetables in native soils for human consumption. b. Use of groundwater as a source of drinking water. c. Indoor occupancy of structures in areas where groundwater contamination has been identified as posing a risk to human health due 	<p>original covers would not be borne by the Navy. For example, the cost of a replacement cover to comply with institutional controls would be a local cost incurred, not a cost borne by the Navy.</p>

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		<p>to volatilization of contaminants, unless the vapor pathway is reduced to an acceptable level through engineering controls or other design alternatives which meet the specifications preliminarily set out in the Containment section of the TMSRA, detailed in the Proposed Plan, ROD Amendment, and Land Use Covenant Remedial Design (LUC RD), as appropriate, and incorporated into the Risk Management Plan described in these comments. As discussed elsewhere in our Comments, it is our understanding that the areas subject to unacceptable vapor risks from groundwater plumes will be adjusted as data demonstrates a change in the area of risk. The Risk Management Plan should reflect that the area subject to special controls as a result of vapor risks is expected to be adjusted over time and provide guidance on how to determine the applicable area subject to such controls at the time of any land disturbing activity.</p> <p><u>Soil Cover Requirement</u></p> <p>The following uses are allowed in all areas as long as the soil is covered to prevent soil exposure in accordance with soil cover specifications (these specifications should be preliminarily set out in the Containment section of the TMSRA, detailed in the Proposed Plan, ROD Amendment, and LUC RD, as appropriate, and incorporated into the Risk Management Plan described in these comments).</p> <ol style="list-style-type: none"> A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation, A hospital for humans, A school for persons under 21 years of age, A day care facility for children, Any permanently occupied human habitation including those used for commercial or industrial purposes, Any other use not specifically prohibited, including but not limited to commercial, industrial, open space, civic and educational uses. 	

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		<p><u>Activities Subject to Site Management Requirements</u></p> <p>The following activities at HPS Parcel B are subject to the conditions set forth below:</p> <ul style="list-style-type: none"> a. Alteration, disturbance, or removal of any component of a response or cleanup action (including but not limited to pump-and-treat facilities, revetment walls and shoreline protection); groundwater extraction, injection, and monitoring wells and associated piping and equipment; or associated utilities is prohibited without the prior review and written approval of the Navy and DTSC, except as provided below in Section (d). b. Land disturbing activities shall only be allowed when conducted pursuant to an approved Risk Management Plan containing the necessary elements detailed in the Proposed Plan and required pursuant to the ROD Amendment and the LUC RD as further explained in these comments. Land disturbing activities include but are not limited to: (1) excavation of soil, (2) construction of roads, utilities, facilities, structures, and appurtenances of any kind, (3) demolition or removal of "hardscape" (for example, concrete roadways, parking lots, foundations, and sidewalks) existing at the time of the ROD Amendment issuance, and (4) any other activity that involves movement of soil to the surface from below the surface of the land or causes the preferential movement of known contaminated groundwater. c. Extraction of groundwater and installation of new groundwater wells for the purpose of dewatering sites as required for redevelopment activities is allowed only when conducted in accordance with an approved Risk Management Plan. See Section (b) above regarding land disturbing activities. d. Removal of or damage to security features (for example, locks on monitoring wells, survey monuments, fencing, signs, or monitoring equipment and associated pipelines and appurtenances) related to Navy activities is prohibited without prior written approval by the Navy. <p>6. <u>Risk Management Plan for Land Disturbing Activities</u></p>	

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		<p>We strongly disagree with the approach to a Soil Management Plan taken in the draft TMSRA, as further detailed in our comments below (pages 4-17 to 4-18). A more appropriate approach is to require the preparation of a Risk Management Plan as part of the remedy. We envision that the Risk Management Plan will set out a process for the proper handling and management of soil during land disturbing activities, groundwater dewatering, and for controls in areas with groundwater plumes where inhalation of VOCs may result in unacceptable exposure risks to construction workers during land disturbing activities or preferential migration of contaminated groundwater may occur. It should establish performance standards and generally applicable specifications; notice requirements prior to conducting specified activities; the procedures and planning to follow during work; the requirements for assuring that soil cover is adequately reestablished; where necessary, vapor barriers are installed, prior to allowing uses subject to such a requirement; and notice requirements upon completion of work. The Risk Management Plan should be based on necessary elements detailed in the Proposed Plan and be required pursuant to the ROD amendment and LUC RD as part of the site remedy. We expect that it will be enforceable through the Navy/DTSC Covenant but we also expect that pursuant to the Navy/DTSC Covenant, a process will be established by which the site-by-site implementation of the Risk Management Plan may be approved and overseen by the City through its adoption of an ordinance.</p> <p>As an additional and necessary layer for ensuring the proper maintenance of institutional controls, it is expected that the Navy/DTSC Covenant will provide for a process in which the City may approve and oversee compliance with a Risk Management Plan by adopting an ordinance that assures specified activities are carried out in accordance with the Risk Management Plan requirements. The City is in a unique position to perform this role because it has permit authority over land uses, infrastructure, building and occupancy, and expertise in implementing deed restrictions within the jurisdiction.</p> <p><u>7. Flaws with the Soil Management Plan as Proposed.</u></p> <p>As part of obtaining approval for restricted land uses, the draft TMSRA</p>	

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		<p>would require the transferee to prepare and submit a SMP providing for cleanup and/or construction to standards protective of human health and the environment for residential land use (page 4-17). The draft TMSRA further states that the SMP shall include any necessary construction plans and schedules, operation and maintenance (O&M) plan requirements, and any supplemental land use restrictions required to protect human health and the environment. The purpose of these requirements, the risks that may be driving them, and need for the inclusion of such requirements in a SMP are unclear to us. We believe that the Risk Management Plan approach set forth in these comments can adequately address matters for which the draft TMSRA calls for a SMP and any reference to the SMP including construction documents, cleanup requirements, supplemental land use restrictions, or establishing O&M obligations should be eliminated.</p> <p><u>8. Operation and Maintenance of Institutional Controls</u></p> <p>The institutional control language in the draft TMSRA states that O&M requirements are to be addressed in the SMP (page 4-17). As indicated above in these comments, however, O&M requirements should be specified by the institutional controls and established in the TMSRA, Proposed Plan, ROD Amendment, and LUC RD, as appropriate. Discussion of institutional controls in the TMSRA should anticipate the need for the institutional controls to operate in conjunction with O&M planning requirements (e.g., for maintaining soil cover), as well as the need for a land use covenant enforcement and implementation plan under California law.</p> <p>For example, the section related to soil cover correctly points out that covers will need to be maintained (page 4-20). However, the Institutional Controls section should go beyond merely noting this and identify the Institutional Control mechanism that will be put in place to assure the maintenance is carried out. As another example, the groundwater section does not clearly discuss the need for vapor barriers or the like or provide any information on the performance standards for maintaining the integrity of such barriers. (4-21 to 4-22). The TMSRA must address this issue.</p>	

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14.	4-17	<p><u>Additional Comments on Section 4.3.2.1, Page 4-17 – Analysis of General Response Actions.</u> The TMSRA also includes as a restricted activity any activity that causes the preferential movement of known contaminated groundwater. In order to evaluate causation of preferential movement of contaminated groundwater, the transferee will require detailed and timely information concerning the extent of contaminated groundwater, existing flow paths and range of influence of injection/extraction wells.</p> <p>The TMSRA states that metals at concentrations above remediation goals are spread throughout Parcel B, and site-wide excavation is not practicable for metals other than lead. However, there are numerous areas where PAHs, pesticides and PCBs have been detected above remedial goals and should be excavated. If the Navy’s previously stated goal of removing CERCLA contaminants from all of Parcel B has been replaced by use of a soil cover, this should be clearly stated. In addition, if the area of IR7/18 has unique characteristics that make the excavation of CERCLA contaminants infeasible then that area should be specifically identified as an area where contaminants at levels above the remediation goals can remain in place and the reasons for not requiring excavation should be clearly explained.</p>	<ul style="list-style-type: none"> At the time of transfer, all up to date information regarding the extent of groundwater contamination will be provided to the transferee. Groundwater flow directions are well characterized in Parcel B groundwater monitoring reports. Any new groundwater information obtained after transfer will also be provided to the transferee in a timely manner. The area of IR-07/18 has unique characteristics including the presence of debris fill and status as a radiologically impacted area. Excavation in the area of IR-07/18 was unsuccessful largely because of the content of the debris fill used to create this area. The location of the area within IR-07/18 that will be subject to additional institutional controls based on the debris fill and potential radiological contamination will be addressed in the radiological addendum to the TMSRA and identified in the LUC RD that will be part of the implementation of the institutional controls. Areas outside of IR-07/18 that contain concentrations of PAHs, pesticides, and PCBs above remediation goals are proposed to be excavated, except those areas where the concentrations exist at 10 feet bgs, are beneath a building footprint, or will be beneath the shoreline revetment.
15.	4-20	<p><u>Section 4.3.2.1, Page 4-20, Containment.</u> Reference is made to using a cover(s) for containment, and potential for removal and replacement of the cover. As the property is redeveloped, the cover will be removed and replaced in different portions of Parcel B over time. The Navy’s report states that covers need to be appropriately maintained or replaced, in conformance with the noted minimum cover requirements. There is no mention of additional sampling requirements related to replacement of covers. We would like to clarify that as long as (1) no obvious environmental conditions are encountered (visual or olfactory evidence of contamination) during redevelopment, (2) the Navy’s minimum cover requirements are met, and (3) no soil leaves the site; then no additional sampling requirements will be imposed, as the proposed remedy would already have been deemed protective by the regulatory agencies that concurred with the Navy’s remedy.</p>	<ul style="list-style-type: none"> The bullet list on page 4-20 under “Containment” will be expanded to include the following bullet. <i>“Sampling requirements associated with disturbance of covers will be in accordance with the RMP.”</i>

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16.	4-19	Page 4-19, Removal (first complete paragraph). States “Excavation is expected to be effective in remediating whatever materials are present in the subsurface at Redevelopment Block 3 that are the source of methane observed in soil gas samples.” It is understood that the source of the methane has not yet been identified and is therefore open to speculation. Nevertheless, it would be beneficial for the purposes of remedial alternative evaluation for this document to state what may reasonably be anticipated to be found in terms of the source of methane. This would assist in the evaluation of this component of the proposed remedial action alternatives, as well as provide a basis for the portion of the cost estimates related to the methane source excavation presented in Appendix D.	<ul style="list-style-type: none"> The following text will be added to page 4-19: “Excavation is effective and implementable...Excavation is expected to be effective in removing whatever materials are present in the subsurface at Redevelopment Block 3 that are the source of the methane observed in soil gas samples. <i>The source of methane is believed to be from the disposal of construction debris, possibly wood that is in contact with groundwater.</i> Excavation depths...”
17.	4-19	Page 4-19 – Excavation along shoreline (2 nd Paragraph). States “These added difficulties make excavation along the shoreline a less attractive option. Therefore, the excavation process option will be retained for only the land-based areas...” The description for Alternative S-3 (p. 5-6, 3 rd bullet item) states that the cost estimate for the shoreline revetment includes disposal of 6,000 cubic yards of contaminated sediment. Please reconcile the apparent contradiction. (See also related comment re. Appendix D, p. D-12.)	<ul style="list-style-type: none"> Please refer to the responses to EPA specific comment 45 and DTSC specific comment 61.
18.	4-20	Page 4-20, Containment, Fourth bullet item. States “All existing or newly installed covers will need to be maintained.” The maintenance costs associated with existing covers appears to have been omitted from the pertinent cost estimates in Appendix D. In addition, the Navy should develop performance standards for the maintenance of the cap and potential subsurface repair activities as part of the TMSRA or Proposed Plan. The details of how the Navy will comply with the performance standards should be written into the Remedial Design documents and then compliance documented in the Remedial Action Close-Out Report.	<ul style="list-style-type: none"> Please refer to the response to DTSC (Lanphar) specific comment 57. The performance standard proposed is: “Where covers are needed, areas will be covered with a durable material that will not break, erode, or deteriorate such that the underlying soil becomes exposed.” Maintenance costs for repairs of original covers (for example, to repair erosion damage) are included on Tables D-4B and D-5B.

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19.	4-21	Page 4-21, No Action Alternative. States “Groundwater would be left as-is without implementation of any institutional controls, containment, removal treatment, monitoring, or other mitigating actions.” If no monitoring will be performed, then the cost estimate (Appendix D) for the “no action” alternative should include abandonment of all existing groundwater monitoring wells.	<ul style="list-style-type: none"> The no-action alternative is required by NCP to provide a baseline to which other alternatives are compared. The no-action alternative evaluates the potential risks if no further action was conducted at the site. No change to the report is proposed from this comment.
20.	4-21	Section 4.3.2.2, Page 4-21. This section should include a description of vapor mitigation system installation and restrictions on disturbing such a system under item “b” on page 4-22.	<ul style="list-style-type: none"> The following text will be added to Section 4.3.2.2 on page 4-22 under the heading “<i>Additional Land Use Restrictions Relating to Groundwater and Associated VOC Vapors at Specific Locations within Parcel B.</i>” “<i>The restricted land uses set forth in Section 4.3.2.1 must be approved by the FFA Signatories in accordance with the ‘Covenant to Restrict Use of Property,’ Quitclaim Deed, and Parcel B RMP prior to such use of the property within the Area Requiring Institutional Controls (ARIC) for groundwater and associated VOC vapors in order to ensure that the risks of potential exposures to VOC vapors are reduced to acceptable levels that are adequately protective of human health. This can be achieved through engineering controls or other design alternatives which meet the specifications set forth in the ROD amendment, RD reports, LUC RD report, and Parcel B RMP. The Parcel B RMP shall provide for adequate soil, vapor, and groundwater sampling and analysis for VOCs. Initially, the ARIC will include all of Parcel B. Institutional controls will be required for an entire redevelopment block if any portion of that block is affected by the potential lateral extent of vapor intrusion. The ARIC may be modified by the FFA Signatories as the groundwater contaminant plume that is producing unacceptable vapor inhalation risks is reduced over time.</i>” Follow-up: The proposed text addition was revised as follows. “<i>The land use restrictions, restricted activities, and prohibited activities discussed under the evaluation of soil process options in Section 4.3.2.1 include the groundwater restrictions that will be placed as institutional controls under the groundwater alternatives.</i>”

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21.	4-23	Page 4-23, Passive Groundwater Treatment. States “Passive groundwater treatment includes the process options of groundwater monitoring and natural recovery.” The term “treatment” is typically associated with active measures, such as pump-and-treat systems or in-situ or ex-situ treatment using chemical additives. We therefore recommend using the industry standard terms of “monitored natural alternation” (MNA) in lieu of “natural recovery.” It should also be noted that MNA is only appropriate for compounds that are known to naturally degrade in the environment (e.g. petroleum hydrocarbons, volatile organic compounds) under favorable conditions, and that MNA typically involves a greater level of effort and cost than typical groundwater monitoring. MNA is not considered appropriate for inert compounds such as metals (e.g., mercury, chromium VI).	<ul style="list-style-type: none"> • Please refer to the response to EPA specific comment 46 on the description of natural recovery, MNA, and groundwater monitoring. • Please refer to the responses to EPA specific comment 61 and DTSC specific comment 58 on groundwater monitoring for mercury.
22.	---	Table 4-1. This table states that included in institutional controls shall be “criteria during and after future development to assure that mitigated exposure conditions are maintained such as covers, barriers, or other engineering controls.” First, this task is long-term O&M associated with the remedy and not an institutional control. Second, costs associated with this action do not appear to be included in the cost estimate.	<ul style="list-style-type: none"> • The repair of asphalt surfaces (for example, from erosion or seismic disturbance), is considered an operation and maintenance (O&M) activity. The cost for maintaining the asphalt is included in the O&M costs for Alternatives S-4 and S-5 (see Tables D-4B and D-5B). Asphalt repair costs are included for 10 years to account for the majority of the redevelopment build out. Requirements in Covenants to Restrict Use of Property or Quitclaim Deeds that regulate future breaches of the cover for redevelopment purposes are considered institutional controls. O&M costs do not include installation or repair of replacement covers placed during development.
23.	---	Table 4-2. The description of Institutional Controls as a GRA, remedial technology type and process option is somewhat confusing. Under Table 4-2, Screening of General Response Actions and Process Options for Groundwater, the use of vapor barriers for new construction is noted as an option under the IC description, but the description also suggests prohibiting certain types of construction and development. The use of vapor barriers as an IC should allow for sensitive land use development because exposures would be mitigated. The descriptions in Table 4-2 indicate land use restrictions prevail over use of a vapor-barrier-based IC. Sources for Table 4-2 need to be updated to include EPA 2000a, EPA 2004, and IRTC 1999. (See also related comment recommending referring to vapor barriers as an “engineering control.”)	<ul style="list-style-type: none"> • The statement “prohibits certain types of construction and redevelopment based on designated land use and must be in accordance with land use restrictions” in the description of institutional controls on Table 4-2 is intended to refer to the more general case of redevelopment, not specific to vapor controls. For example, residential construction would not be allowed in areas designated for open space land use without review and approval by the FFA Signatories. In this sense, land use restrictions take precedence over vapor controls, but types of construction that are consistent with the planned reuse would not be restricted, so long as the proposed construction meets the requirements related to mitigating vapor intrusion. Please refer to the response to City specific comment 20 for

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			<p>more details about vapor controls.</p> <ul style="list-style-type: none"> References for EPA 2000a, EPA 2004c, and ITRC 1999 are listed in the references on Table 4-3 and will be added to Table 4-2. Please refer to the response to City specific comment 12 for discussion of vapor controls as engineering controls.
24.	---	<p><u>General Comment on Section 5.0.</u> It is difficult to reconcile the grids that had sample results that exceeded remedial goals (Table 3-22) with the grids that have excavation proposed for remediation (Table 5-1). Table 5-1 should be revised to include information on the chemicals that exceed remediation goals, along with the soil alternative information.</p> <p>See comment to Section 5.2.3 (below), which indicates that excavation is not proposed for multiple grids with lead or organics in soil that exceed remediation goals. Table 5-1 does not provide the rationale for why no excavation is proposed for these other grids and Section 5.0 does not appear to include the rationale for why excavation was not proposed.</p> <p>We suggest adding a table listing all grids with elevated lead and organics and then identifying which grids will not be excavated and the rationale for not requiring excavation.</p>	<ul style="list-style-type: none"> Please refer to the response to City specific comment 30 below.
25.	5-1	<p><u>Page 5-1, §5.1 – Development of Remedial Alternatives, Second Paragraph.</u> States “Various institutional controls are also integrated with each alternative to assure that RAOs and ARARs are satisfied.” In subsequent sub-sections, the ICs are not integrated with each alternative; it is left at least partially to the transferee to develop the specific ICs. Therefore, without at least a description or listing of the specific ICs that would be required for each alternative, it is impossible to evaluate whether or not a particular alternative is protective in the long term or meets ARARs.</p>	<ul style="list-style-type: none"> The list of institutional controls contained in Section 4.3.2.1 is comprehensive and provides one location within the TMSRA for information on institutional controls. Listing of all institutional controls for each alternative would repeat many institutional controls several times and may make the TMSRA more confusing.
26.	---	<p><u>Section 5.1.2 – Alternatives for Groundwater.</u> This section refers to Section 4.3 for more detail about ICs, but no discussion of vapor barriers and/or passive ventilation systems is provided in Section 4.3.</p>	<ul style="list-style-type: none"> Please refer to the response to City specific comment 20 for more details about vapor controls.

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27.	5-2	Page 5-2, Alternatives Developed for Soil. It is not clear exactly how each of the alternatives will address each of the risks identified in the Health Risk Assessment. Therefore, it is difficult to evaluate (Section 6.0) whether a particular alternative meets, for example, the protectiveness criterion. We recommend that the linkage between distinct risks (or categories of risk) be clearly and explicitly carried through the document from Section 3.0 to Section 6.0.	<ul style="list-style-type: none"> Table 5-1 lists all redevelopment blocks with COCs exceeding remediation goals and describes how each alternative will address those blocks. Please refer to the response to City specific comment 30 for additions to Table 5-1 and Section 5.2.3.
28.	5-2	<p>Page 5-2, Alternative: S-2: Institutional Controls and Shoreline Revetment. States "Alternative S-2 uses institutional controls and constructing a shoreline revetment that, together, will meet all ARARs and RAOs." A listing of ICs envisioned for this alternative is needed to fully evaluate this alternative in Section 6.0.</p> <p>The cost estimates presented in Appendix D include extremely minimal costs for ICs. The only items included are signage, deed restrictions, preparation of the LUC RD, and preparation of the FOST. Additional items that should be included (as well as the cost for these items) are: additional public protection measures such as fencing and more effective (than exist currently) security measures; preparation of the Risk Management Plan the costs of implementing the LUCs and enforcing the deed restrictions; creation and long-term maintenance of a GIS database containing all of the analytical data for the parcel.</p>	<ul style="list-style-type: none"> Appendix D will be modified to include estimates for future Navy costs related to implementation of institutional controls. Please also refer to the response to City specific comment 39, below.
29.	5-2	<p>Page 5-2, Alternative S-3: Excavation, Methane Source Removal, Disposal, Institutional Controls, and Shoreline Revetment. "This alternative will provide a more permanent remedy to reduce the volume and toxicity of contaminants where excavation is feasible. The ICs under this alternative would be used to prevent exposure to potential unacceptable risk posed by other COCs in soil (that is, the ubiquitous metals at concentrations above remediation goals)." Excavation and disposal will not reduce the volume and toxicity of contaminants; mobility of contaminants may be reduced by disposal at an appropriate facility, as opposed to leaving (uncovered) contaminated soil in an uncontrolled environment and that concept should be clearly stated here.</p> <p>ICs could be used to prevent exposure to ubiquitous metals at concentrations above remediation goals. A listing of ICs envisioned for this alternative is needed to fully evaluate this alternative in Section 6.0.</p>	<ul style="list-style-type: none"> Section 5.1.1 will be revised as follows: "Alternative S-3 consists of... This alternative will provide a more permanent remedy to reduce the volume and toxicity of remove contaminants where excavation is feasible. The institutional controls..." The rating for "Reduction of Toxicity, Mobility, or Volume through Treatment" for Alternative S-3 will be changed to "poor" based on EPA specific comment 67. The list of institutional controls contained in Section 4.3.2.1 is comprehensive and provides one location within the TMSRA for information on institutional controls. Listing of all institutional controls for each alternative would repeat many institutional controls several times and may make the TMSRA more confusing.

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30.	---	<p>Section 5.2.3 – Alternative S-3: Excavation, Methane Source Removal, Disposal, Institutional Controls and Shoreline Revetment. This section includes identification of areas proposed for excavation, which include soil excavation for lead at B3415 (Redevelopment Block 8) and at B3426 (Redevelopment Block 9), as well as excavation for organic compounds at B4716 (Redevelopment Block 15) and the methane source excavation at B1031 (Redevelopment Block 3). As noted in Section 5.1.1, Alternatives Developed for Soil, Page 5-2, “Areas where organic compounds (including the methane source) and lead are COCs will be excavated to remediate these COCs to remediation goals.”</p> <p>There are several grid areas identified in Table 3-22 as having COCs in soil at concentrations greater than remediation goals that were not included in the proposed excavation areas in Section 5.2.3. The following grids should be either included in the proposed excavation areas or the rationale should be included stating why the specific grids were not proposed for excavation</p> <p>Redevelopment Block 2</p> <ul style="list-style-type: none"> • B1042 – lead and dibenz(a,h)anthracene • B0366 – lead • B0438 - lead <p>Redevelopment Block 3</p> <ul style="list-style-type: none"> • B1028 – lead • B1029 – Aroclor 1260, dieldrin and heptachlor epoxide • B1128 – lead • B1129 – Aroclor 1254, Aroclor 1260, Beta-BHC, dieldrin, and heptachlor epoxide • B1130 – lead, benzo(b)fluoranthene, benzo(k)fluoranthene, Aroclor 1260, dieldrin, and heptachlor epoxide 	<ul style="list-style-type: none"> • The last bullet in Section 5.2.3 will be expanded as follows. “All other areas that present potential unacceptable incremental risk...addressed through the use of institutional controls. <i>The following bullets provide specific examples.</i>” <ul style="list-style-type: none"> ○ <i>Excavation is not proposed for any areas at Redevelopment Blocks 2, 3, and BOS-1 based on the presence of debris fill in those areas and the known difficulties of attempting removals in debris fill areas.</i> ○ <i>Excavation is not proposed beneath existing buildings; building slabs and foundations act as adequate covers (grid B1626 and grids at Redevelopment Block 8).</i> ○ <i>Excavation is not proposed to remove contaminants present at 10 feet bgs; the overlying soil acts as an adequate cover (grids B4017, B4520, AX04, and AY03).</i> • Similar notes will also be added to Table 5-1.

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		<ul style="list-style-type: none"> • B1131 – benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene • B1228 – lead • B1230 – lead, Aroclor 1260, and dieldrin • B1231 – benzo(a)anthracene • B1328 – Aroclor 1260 • B1330 – benzo(a)anthracene, naphthalene, Aroclor 1254, dieldrin, and heptachlor epoxide <p>Redevelopment Block 6</p> <ul style="list-style-type: none"> • B1626 – PCE in soil at excess cancer risk $>1 \times 10^{-6}$ • Redevelopment Block 8 • B2723 – TCE • B2724 – TCE • B2823 – TCE • B2824 – TCE • B2923 – TCE • B2924 – TCE <p>Redevelopment Block 12</p> <ul style="list-style-type: none"> • B4017 – benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene • B4520 – Aroclor 1260 	

TABLE 5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

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		<p>Redevelopment Block 15</p> <ul style="list-style-type: none"> AX04 – benzo(a)pyrene AY03 – benzo(a)anthracene and benzo(a)pyrene <p>Attached are flowcharts illustrating examples that follow individual risk grid areas through the process outlined in various portions of the TMSRA and then determining whether the grid is slated for excavation or not. These flowcharts are intended for illustrative purposes only; however, it is recommended that some sort of guidance, both in the text of the document itself and possibly with the visual aid of some type of “generic” flowchart, be provided so that the reader can readily follow the logic being applied to each grid area that has an exceedance.</p> <p>As another example of where additional clarification (text) is needed, it is noted that some of the CERCLA contaminants are in the IR7/18 area. If the area of IR7/18 has characteristics that make the excavation of CERCLA contaminants infeasible then the characteristics should be described and that area should be specifically identified as an area where contaminants at levels above the remediation goals will not be excavated.</p>	
31.	5-3	<p><u>Page 5-3, Alternative S-4: Covers Methane Source Removal, Institutional Controls, and Shoreline Redevelopment.</u> “The institutional controls are discussed in Section 4.3, would be implemented parcel-wide, and would be more fully described in an LUC RD document.” Please see our specific comments on Section 4.3 and Institutional Controls.</p>	<ul style="list-style-type: none"> Please refer to the responses to specific comments on Section 4.3.
32.	5-3	<p><u>Page 5-3, Alternative S-5.</u> Same comment as above for Alternative S-4.</p>	<ul style="list-style-type: none"> Please refer to the responses to specific comments on Section 4.3.
33.	5-4	<p><u>Page 5-4, Alternative GW-2 and GW-3A and GW-3B.</u> Same comment as above for Alternative S-4.</p>	<ul style="list-style-type: none"> Please refer to the responses to specific comments on Section 4.3.

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34.	5-11	<p>Page 5-11, re. Alternatives GW-3A and GW-3B, last bullet item. States “If, during this monitoring, VOCs are detected along the boundary between Parcels B and C at concentrations that require action, the remedies proposed for the IR-25 plume under the Parcel C FS would be pursued.” It would be appropriate to provide a very brief description of the possible IR-25 plume remedies here for completeness.</p>	<ul style="list-style-type: none"> • The remedies proposed for the IR-25 plume are expected to be similar to those presented for groundwater in the TMSRA. Alternatives have not been finalized for Parcel C. No change to the text is proposed from this comment.
35.	6-5	<p>Page 6-5, §6.1.2.4, Alternative S-2, Reduction of TMV. States, “The exposure to COCs that present a potential unacceptable risk would be eliminated because the institutional controls include maintaining the fences and signs as well as maintaining the covers.” It is unclear how the cost estimates presented in Appendix D include any cost for maintaining fences, and it appears that the cost of maintaining existing covers has not been included.</p>	<ul style="list-style-type: none"> • The costs for maintaining the asphalt covers and shoreline revetment are included on Tables D-4B, D-4C, D-5B, and D-5C. Only Navy costs related to O&M of the original covers are included (for example, to repair erosion); costs for replacement covers or repairs to replacement covers placed during redevelopment will not be included. • The cost estimates assume that signs would be sufficient to restrict access. The LUC RD will evaluate appropriate ICs and the remedial design will evaluate engineering controls.
36.	---	<p>Section 5.3.2. This section refers to Section 4.3 for more detail about ICs, but no discussion of vapor barriers and/or passive ventilation systems is provided in Section 4.3. This section indicates that “institutional controls would be in place where there is potential unacceptable risk from the vapor intrusion pathway and require engineering controls for all new buildings constructed in redevelopment blocks where groundwater plumes may present potential unacceptable risk from the vapor intrusion pathway.” Since this sentence refers to “unacceptable risk” rather than unacceptable risk as noted in Section 3.0 of the TMSRA or groundwater concentrations greater than the remediation goals outlined in Table 3-18, is the assumption that “unacceptable risk” will be determined based on other data and a separate evaluation? This could include a re-evaluation of the extent of the groundwater plume based on any new data collected or based on future soil gas data that could be collected to confirm the presence of VOCs at concentrations that would represent potential vapor intrusion risks, which is consistent with the 2005 DTSC <i>Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air</i>. If so, these options should be outlined accordingly.</p>	<ul style="list-style-type: none"> • Please refer to the response to City specific comment 26. • The term “unacceptable risk” used in Section 5.3.2 means the same as stated in Section 3.0: concentrations of COCs above remediation goals. No change to the report is proposed from this comment.

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37.	---	<u>Figure 5-6.</u> Groundwater flow directions should be indicated on this figure.	<ul style="list-style-type: none"> Groundwater flow directions are shown on Figure 2-5. The TMSRA is not intended to provide a comprehensive groundwater monitoring plan. Please refer to Parcel B groundwater monitoring reports for additional details on groundwater flow directions. No change to the figure is proposed from this comment.
38.	A-38	<u>Risk Characterization for Residential and Industrial Exposure to Groundwater, Section A7.2, Page A-38.</u> The text in the first bullet states that the screening levels used for evaluation of risks associated with vapor intrusion are based on generic attenuation factors that assume minimum reduction of contaminant concentrations. While the use of screening levels may be appropriate for determining whether further evaluation is needed, they may not be appropriate for estimating site-specific risks and hazards. At a minimum, further discussion is needed here to describe whether actual site-specific conditions are consistent with those used in the development of the screening-level attenuation factors, and why the expected likely future residential construction would not be sufficiently different from the assumptions in the screening level analysis to justify site-specific modeling to estimate contaminant concentrations in indoor air.	<ul style="list-style-type: none"> Please refer to the response to City comment number 4.
39.	---	<p><u>Appendix D General Comment.</u> General Comment: The costs included in the Appendix D tables for institutional controls (ICs) (including land use controls (LUCs) and engineering controls (ECs)) as well as for long-term operations and maintenance (O&M) appear to be low and/or incomplete.</p> <p>At a minimum, IC and O&M costs should include the following items, as appropriate to each remedial alternative:</p> <ul style="list-style-type: none"> Prepare Deed Restrictions Enforcement of Deed Restrictions Maintain Signage for Public Protection (all alternatives) Land Use Controls Remedial Design (LUC RD) 	<ul style="list-style-type: none"> Responses related to each cost item are listed separately below. Appendix D will be modified to include estimates for future CERCLA response costs incurred by the Navy related to implementation of institutional controls. Costs incurred by the Navy for preparing and enforcing deed restrictions will be added to Appendix D. Costs incurred by the Navy related to signage are included in the current estimates. Costs incurred by the Navy to prepare the LUC RD will be added to Appendix D. Costs incurred by the Navy to prepare the land use covenant and FOST

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		<ul style="list-style-type: none"> • Land Use Covenant between Navy and DTSC • Preparation of FOST • Long-term Operation and Maintenance associated with soil caps (where applicable) • Actions to address soil cap during future development – installation • Actions to address soil cap during future development – review • Actions to address soil vapor during future development – installation • Actions to address soil vapor during future development – review • Dewatering Plans prepared and submitted during development – review • Preparation and approval of Ordinance and Implementing Regulations by CCSF. The Ordinance and Regulations would allow DPH to assume responsibility for the day to day review and approval of plans and permits that verify compliance with the standards in the Risk Management Plan • GIS/Database management and updates for environmental data and ICs • Preparation of a Risk Management Plan (RMP) to guide soil and groundwater management and IC maintenance during redevelopment • Regulatory oversight of RMP and ordinance implementation 	<p>will be added to Appendix D.</p> <ul style="list-style-type: none"> • Long-term operation and maintenance (O&M) costs incurred by the Navy for covers are included in the current O&M estimates. Only costs related to O&M of the original covers are included (for example, to repair erosion); costs for repairs of original covers as a result of redevelopment activity; costs of replacement covers installed in the course of redevelopment; and costs of repairs to replacement covers placed during redevelopment will not be included. • Costs incurred by the Navy for actions related to future redevelopment including review, oversight, or installation of soil covers, vapor controls, and dewatering will be included. • Costs incurred by non-Navy entities for preparing ordinances and regulations are not integral components of the remediation alternatives and no costs will be provided. • Costs incurred by the Navy to prepare a GIS and data management system will not be added to Appendix D. Data management is an overall program cost for the Navy and not apportioned to HPS or Parcel B in particular. The Navy already has GIS and data management systems in use (NEDD/NIRIS). • Costs incurred by the Navy during preparation of the RMP by the City will be provided. • Costs incurred by the Navy during oversight of the RMP will be provided.
40.	---	<p><u>Tables D-2B, D-3B, D-4B, D-5B, D-7B, D-8B, and D-9B – All Alternatives.</u> The purpose of the “Annual Drive-By Inspection” is not clear. Is this task limited to inspection of the signage (signage is the only physical institutional control proposed for all alternatives)? This task should not be confused with long-term O&M inspections associated with the remedy.</p>	<ul style="list-style-type: none"> • The “Annual Drive-by Inspection” is intended to support the 5-year review in monitoring the effectiveness of the remedy, including ICs, covers, etc. Annual inspections may also support the requirements of the LUC RD. No change to the report is proposed from this comment.

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41.	4-17	<u>Page 4-17; All Alternatives.</u> Lists several land use requirements that will require the attention of the Navy and DTSC, including review, approval, and follow-up of submitted SMPs and facilitation of a covenant to restrict property use. The long-term costs associated with the “review, approval, and follow-up of submitted SMPs” do not appear to be included in the estimated costs. DTSC-invoiced costs associated with this task also do not appear to be included in the cost estimate. In addition, if everyone agrees that CCSF should play a role in this review and approval process, then the costs for the CCSF need to be included in the cost estimate.	<ul style="list-style-type: none"> The concept of a soil management plan has been incorporated into a document currently known as a risk management plan. Preparation of a RMP and oversight of the RMP implementation are not integral components of the remediation alternatives and no costs will be provided for these activities. Also refer to the response to City specific comment 39. No change to the report is proposed from this comment.
42.	---	<p><u>Tables D-2B, D-3B, D-4B, D-5B, D-7B, D-8B, and D-9B – All Alternatives.</u> The “Shoreline Revetment Inspection” task has been improperly listed as an institutional control. This task is really long-term O&M associated with placement of the revetment.</p> <p>Table D-2B suggests the O&M costs associated with ICs to be approximately \$134,000. Lennar’s experience at Mare Island has indicated that costs associated with monitoring of ICs, including inspections, permit tracking, annual and 5-year review reports, DTSC and EPA oversight costs, as well as costs to local government, is projected at approximately \$5 million for a 450-acre area.</p>	<ul style="list-style-type: none"> The “Shoreline Protection Inspection” is not listed as an IC, but is intended to support the 5-year review in monitoring the effectiveness of the remedy and to identify areas that may need maintenance and repair. The costs for inspection and 5-year review are based on engineering judgment, using the costs for conducting a 5-year review at Hunters Point in 2003.
43.	---	<u>Table D-4B (Soil Alternative S-4, Cover) and Table D- 5B (Soil Alternative S-5, Cover and SVE).</u> The long-term operation and maintenance costs associated with these alternatives do not appear to be included in the cost estimates. Long-term O&M for a soil cover would typically include a periodic inspection, provisions for cover repair, and reporting. Long-term O&M for an SVE system would include system monitoring, routine repairs, replacement of carbon (if necessary), reporting, etc.	<ul style="list-style-type: none"> The costs for asphalt maintenance and annual inspections are included on Tables D-4B and D-5B, under “Asphalt Maintenance Year 10” and “Annual Drive-by Inspection.” O&M costs also include inspection and repair of the shoreline revetment (under heading “10 Year Shoreline Protection Inspection”). Asphalt repair costs are included for 10 years to account for the majority of the redevelopment build out. O&M costs do not include installation or repair of replacement covers placed during redevelopment. It is assumed that the SVE system would operate for 1 year (Section D6.4, assumption number 10). Therefore, the costs to operate the SVE system are included in the capital costs (Table D-5A).

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44.	---	Table D-4A (Capital and Labor Cost Estimate Alternative S-4), Table D-4B (O&M and Periodic Cost Estimate, Alternative S-4), Table D-5A (Capital and Labor Cost Estimate Alternative S-5), Table D-5B (O&M and Periodic Cost Estimate, Alternative S-5). Capital costs for cover under S-4 and S-5 (Table D-4A and Table D-5A) refer to installation of a 4-inch asphalt layer over the applicable redevelopment blocks (except the three open space blocks). O&M costs are included for the new covers to be installed under Alternative S-4 and S-5, but no O&M costs for Redevelopment Blocks 1, 4, 5, 16 and BOS-2, which reportedly have existing covers. As noted in Section 5.1.1 (Alternatives Developed for Soil, Page 5-3), “the need for upgrades or repairs to existing covers would be assessed in the remedial design and implemented for this alternative as necessary.” Section 4.3.2.1, Evaluation of Applicable Soil Process Options (Page 4-20) indicates that “existing asphalt can be renovated with an asphalt seal coat, and concrete surfaces and building floors can be patched so long as the patches and seals adequately break the pathway.” Because any asphalt existing cover will either require the same O&M as the new asphalt cover or the patching and sealing referenced in Section 4.3.2.1, a general estimate of O&M for the existing cover should be included in Tables D-4B and D-5B.	<ul style="list-style-type: none"> • The Navy proposes covers parcel-wide. • O&M costs will be added for maintenance of all asphalt covers. Only Navy costs related to O&M of the original covers are included (for example, to repair erosion); costs for replacement covers or repairs to replacement covers placed during redevelopment will not be included.
45.	D-12	Page D-12, §6.1.18, Third bullet item. States “Existing beach material will be dredged for offshore work... The dredged material will be sampled and disposed of offsite as a non-hazardous waste.” This is inconsistent with the third bullet item on Page 5-6, which states that “the cost estimate for the shoreline revetment includes disposal of 6,000 cubic yards of contaminated sediment.” The reader should be referred to (i.e., give document title and date) the historical data that has been collected indicating whether or not the sediment off of Parcel B is contaminated.	<ul style="list-style-type: none"> • The third bullet on Page 5-6 will be revised with the following text: “...includes disposal of 6,000 cubic yards of contaminated sediment <i>to establish appropriate grades and to allow placement of erosion control materials at appropriate elevations relative to sea level.</i>” Please also refer to the response to DTSC (Lanphar) specific comment 61.
46.	---	Table D-2B, Alternative S-2. Costs include an annual drive-by inspection (\$5,200 annually as well as a 5-year report on site inspection \$77,573 each). What is the scope and purpose of these site inspections? Inspection of signage? What about the annual costs of legal controls?	<ul style="list-style-type: none"> • Please refer to the responses to City specific comments 40, 42, and 43.
47.	---	Table D-3B, Alternative S-3. Same comments as above for Table D-2B.	<ul style="list-style-type: none"> • Please refer to the responses to City specific comments 40, 42, and 43.

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48.	---	<u>Table D-4B, Alternative S-4.</u> Considering that Parcel B is entirely paved under this alternative, what is the scope and purpose of the annual inspections? How is it different from/same as scope for Alternatives S-2 and S-3? What about the annual costs of legal controls?	<ul style="list-style-type: none"> Please refer to the responses to City specific comments 40, 42, and 43.
49.	---	<u>Table D-5B, Alternative S-5.</u> Same comments as above for Table D-4B.	<ul style="list-style-type: none"> Please refer to the responses to City specific comments 40, 42, and 43.
50.	---	<u>Table D-7B, Alternative GW-2.</u> Per-event Report Preparation cost of \$9,792 appears to be very low; will this report include text and figures, or be only a "data dump"? Close-out report cost of \$8,960 also appears to be very low. The Scope of Annual drive-by inspections and 5-year site inspections for the groundwater alternatives (as compared to soil alternatives) should be clarified.	<ul style="list-style-type: none"> The costs for preparation of the groundwater monitoring report will be reviewed based on costs for recent quarterly monitoring reports, and adjusted as necessary. The annual drive-by inspection is intended to support the 5-year review in monitoring the effectiveness of the remedy.
51.	---	<u>Table D-8B, Alternative GW-3A.</u> Same comments as above for Table D-7B.	<ul style="list-style-type: none"> Please refer to the response to City specific comment 50.
52.	---	<u>Table D-9B, Alternative GW-3B.</u> Same comments as above for Table D-7B.	<ul style="list-style-type: none"> Please refer to the response to City specific comment 50.
53.	---	<p><u>General Comment on future decision process for VOCs in groundwater.</u> Unlike the majority of the soil, the groundwater with VOC contamination will undergo further treatment. After the remedial action is completed the areas that have been treated will be defined and the areas that require engineering controls (vapor barriers, passive venting, active venting etc.) will need to be defined. The process for defining these post remedial actions areas should be spelled out in the TMSRA, Proposed Plan, or LUC RD. Then the maps defining the areas still requiring engineering controls after remediation activities have been completed, based on this pre-approved process, should be presented and approved in the Remedial Action Close-Out Report.</p> <p>The steps in the pre-approved process might be as follows:</p> <p>a. Design and implement groundwater treatment through the remedial design and remedial action process.</p>	<ul style="list-style-type: none"> Areas requiring engineering controls will be identified in the remedial design. Institutional controls will be identified in the LUC RD. The remedial design would require that construction is conducted in a manner that is protective of human health and that the exposure of residents to VOCs in groundwater would be prevented, possibly through the use of vapor controls or other engineering controls. Please also refer to the response to EPA specific comment 53.

TABLE 5: DRAFT RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
		<p>b. Document the area of treatment and reduction of contamination in the Remedial Action Close-Out Report with maps showing the size of the plume (pre- and post-remediation). Use an agreed upon methodology (number and timeframe of sampling events) to properly document the post-treatment extent of the plume.</p> <p>c. Use the DTSC guidance to draw a 100-foot buffer around the post-treatment plume and mark that area as the minimum area that will require soil vapor-related engineering controls. (The area(s) set forth in TMSRA Figure A-8 are overly conservative.)</p> <p>d. The determination of the area requiring controls at the time of the publication of the Remedial Action Close-Out Report will be documented in that report. There would be an agreement established on how the minimum area would relate to the redevelopment blocks and therefore what area would actually end up with engineering controls.</p> <p>e. The report will also document the procedure that someone can undergo if they wish to change the area that is designated as requiring engineering controls. The procedure would be essentially as written above, however the approval process would be with the Navy's designee (probably DTSC or its designee).</p> <p>The process generally described above may be included either in the TMSRA or a later document, but it should be agreed upon by the various parties and documented prior to transfer of Parcel B.</p>	

TABLE 6: DRAFT RESPONSES TO COMMENTS FROM ARC ECOLOGY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

The table below contains the responses to comments received from Arc Ecology on the “Draft Parcel B Technical Memorandum in Support of a Record of Decision Amendment [TMSRA], Hunters Point Shipyard, San Francisco, California,” dated March 28, 2006. Comments were submitted by Chein Kao (Arc Ecology) on June 15, 2006. Throughout this table, *italicized* text represents proposed additions to the TMSRA and ~~strikeout~~ text indicates locations of proposed deletions. Throughout this table, references to page, section, table, and figure numbers pertain to the draft TMSRA, even though some of these numbers have changed in the draft final TMSRA.

No.	Page	Comment	Response
General Comments			
1.	---	This technical memorandum relies heavily on the conclusions of several previous studies. Yet the text does not provide any details of the previous studies nor does it make references to specific pages or provide clear examples of previous documents. While it is understandable not to repeat what has been published, it would be easier for the readers if, for example, some excavation results reported in the Construction Summary Report (CSR) or CSR Addendum (CSRA) can be presented to demonstrate chemical distributions are not in “particular pattern”.	<ul style="list-style-type: none"> Incorporation of confirmation soil sample results from individual excavations (such as is presented in the construction summary report) would not further support the description of the ubiquitous nature of metals in soil at Parcel B. The TMSRA is not intended to reproduce information that is available in existing reports. The references provided in the text are sufficient to allow readers to locate the cited information. No change to the report is proposed from this comment.
2.	---	There appears to be a conflict between changing the site conceptual model to one that advocates “distributions of chemicals are in no particular pattern” and continuing to use data collected based on the old model for risk assessment. In other words, if one believes the distributions of contaminants are in “no particular pattern” or are “unpredictable”, then sample(s) collected within the risk grid can no longer be representative for the grid area for risk calculation.	<ul style="list-style-type: none"> Remediation alternatives in the TMSRA address potential unacceptable risk caused by the widespread distribution of ubiquitous metals at Parcel B. The distribution of contaminants does not affect the risk calculation methodology; the grid only serves to divide the area into individual exposure areas for residential and non-residential exposures. The current HHRA methodology, including the grid system, is adequate to assess potential exposures and summarize risk estimates. Please also refer to the response to EPA general comment 1 and DTSC (Lanphar) specific comment 17. No change to the report is proposed from this comment.
3.	---	TMSRA defines both remediation goals and remedial action objectives based on incremental risks (which we disagree) and devoted over three thousand (3,000) pages of risk calculations for Human Health Risk Assessment (HHRA). However, the true driver for the change of ROD is the “ubiquitous nature” of certain chemical distribution in fill material. Risk calculations become irrelevant when it comes to final remedial alternative analysis since risks calculated based on samples within the risk grid becomes unreliable due to the unpredictable nature of chemical	<ul style="list-style-type: none"> Details of the HHRA are confined to Appendix A and summary information included in the main text of the TMSRA is intended to be as concise and comprehensible as possible for the general audience for this report. The Navy will continue to work to simplify language and present technical material in ways that are understandable by the general public; however, no specific changes to the report are proposed from this comment.

TABLE 6: DRAFT RESPONSES TO COMMENTS FROM ARC ECOLOGY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
		distributions. It is also the ubiquitous nature and unpredictable pattern of chemical distribution rendered excavation and off-site disposal as primary remedial option impractical to implement. This left parcel-wide cover and institutional control the only feasible remedy to address the potential risks from soil. We suggest risk assessment sections in the TMSRA be removed from this report to make issues simpler and the document easier for readers to comprehend.	
4.	---	Remedial alternatives analysis in this document is basically an evaluation of a series of combined process options that progressively add various levels of protectiveness to the alternative. It does not provide a true comparison of alternatives that can satisfy the remedial action objectives without relying on duplicated protections. (i.e. combine excavation, cover, and institutional control into one general response action (GRA) is not a true alternative to another GRA with only cover and institutional control).	<ul style="list-style-type: none"> The use of individual process options in more than one remediation alternative allows for flexibility in designing several alternatives that could successfully remediate Parcel B. Limiting remedial alternatives as described would likely result in only one alternative passing the alternatives screening. This would defeat the purpose of evaluating several, workable alternatives that is one of the objectives of the TMSRA. No change to the report is proposed from this comment.
Specific Comments			
1.	---	<p>Public Summary, Executive Summary, and Section 1-1: "Parcel B has completed cleanup steps through ROD, Remedial Action, and Post-construction reporting." This statement should be deleted.</p> <p>Navy published Post-construction report in the form of Construction Summary Report (CSR) and CSR Amendment (CSRA) dated September 8, 2004. Section 4 Conclusion of the CSRA states: "the RA (Remedial Action) at Parcel B is not complete." DTSC also stated in its comment letter for the CSRA " DTSC agrees with the Navy's general conclusion that remedial actions for Parcel B sites in the Construction Summary Report Addendum (CSRA) are not completed. However, the Navy does not present site-specific conclusions in the CSRA regarding the adequacy of each remediation to meet cleanup goals, the extent of residual contamination, and the risk posed by remaining contaminants. The CSRA comprises primarily data tables and figures." With the ROD pending amendment, the RA incomplete by the Navy's own account, and the post-construction report (CSRA) inadequate according to the regulator, the above statement in the Public Summary and Executive Summary is inaccurate and should be deleted.</p>	<ul style="list-style-type: none"> The remainder of the cited sentence "...however, updated knowledge of the site that became available during the remedial action indicates that modifications to selected soil and groundwater remedies should be considered to ensure long-term protectiveness" clearly indicates that there are on-going activities related to the ROD and remedial actions. No change to the report is proposed from this comment.

TABLE 6: DRAFT RESPONSES TO COMMENTS FROM ARC ECOLOGY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
2.	ES-1	<p>ES-1 Executive Summary:” The updated information about the ubiquitous nature of certain chemicals in soil and more comprehensive understanding of groundwater...” and page 2-17: The ubiquitous nature of metals in fill is much clearer now than in initial design of remedial action...”</p> <p>TMSRA needs to provide more specifics in justifying the change of site conceptual model. It makes no reference to previous studies nor does it provide enough detailed explanation to demonstrate the disagreement between the original model and RA field results. Since this is “large part of the reason for the reevaluation presented in TMSRA...”(page 2-17), there should be a summary of soil remedial action conducted so far and provide clear evidences that field data from remedial actions is not in conformity with previously assumed model.</p>	<ul style="list-style-type: none"> Sections 2.1.3.1 (History of Soil Actions) and 2.3.1 (Updated Characterization of Soil and Groundwater, Overview of Soil) provide information about the updated understanding of soil contamination at Parcel B. The discussion of the widespread distribution of ubiquitous metals summarizes the evidence from field data that shows the need to modify the previous conceptual site model. Please refer to DTSC (Lanphar) specific comment 17 for discussion of additional text to explain changes to the conceptual site model.
3.	ES-5	<p>ES-5 “ The total risk results for soil show that many exposure areas exceed excess lifetime cancer risk threshold...Under the incremental risk evaluation fewer areas at Parcel B exceed cancer or non-cancer risk thresholds because metals below ambient levels (those considered by the Navy to be natural occurring) were excluded from risk analysis. ...Remediation goals were developed for each chemical of concern by comparing the highest concentrations that do not present unacceptable incremental risk with chemical-specific applicable or relevant and appropriate requirements...” and ES-6, “Remedial action Objectives for Parcel B soils are developed based on human health receptors and results of the incremental risk assessment.”</p> <p>Both Remediation goal and Remedial Action Objectives should be developed based on total risks instead of incremental risks. When comparing aerial photos of 1940’s and 1980’s, it is clear all land at Parcel B between 1940’s shoreline and 1980’s shoreline are created by imported material. Imported materials, by definition, are not considered to be natural occurring nor should chemicals in the imported material be considered ambient. Navy should address total risks posed by all material that are imported by Navy’s activities.</p>	<ul style="list-style-type: none"> Total risk includes risk posed by all chemicals, including ubiquitous metals. The incremental risk addresses chemicals related to Navy activities. Remediation alternatives in the TMSRA are focused on cleaning up those chemicals related to Navy activities. Therefore, the TMSRA uses the incremental risk evaluation as the basis for alternative identification. However, remedial alternatives in the TMSRA are designed to also be protective of risks from ubiquitous metals, regardless of source. Please refer to the response to EPA general comment 5 concerning naturally occurring metals in fill materials. No change to the report is proposed from this comment.

TABLE 6: DRAFT RESPONSES TO COMMENTS FROM ARC ECOLOGY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
4.	---	Soil Alternative S-2 is not a complete remedial alternative, as it does not address methane gas.	<ul style="list-style-type: none"> Exposure to methane would be eliminated using institutional controls under Alternative S-2. No access would be permitted to the area affected by methane. No change to the report is proposed from this comment.
5.	2-3	<u>Page 2-3 Shoreline sediment investigation</u> The text states, “Many samples at IR-26 were not collected because riprap interfered with sample collection (that is, no sediment present) ...” Navy interprets riprap interference of sample collection means no sediment present. Shoreline contaminations caused by contaminated soil eroded into bay water along shoreline is likely to be at the bottom of riprap. In order to determine if shoreline revetment is required at IR-26, soil (or sediments) at the bottom of riprap must be sampled.	<ul style="list-style-type: none"> Additional sampling is not necessary to support the need for remedial action to address sediments along the shoreline. The remediation alternative proposed for the shoreline (revetment) will be uniformly applied to the entire shoreline. Consequently, additional sampling is not required for the remediation to be protective of ecological receptors. No change to the report is proposed from this comment.
6.	3-1	<u>Page 3-1</u> “An additional soil removal in 2004 and 2005 resulted in additional excavation and data collection” Table 1-1 shows no further field excavation after Dec 2001. Please correct this discrepancy.	<ul style="list-style-type: none"> Table 1-1 indicates steps in the CERCLA process. The excavations completed in 2004 and 2005 addressed fuel-related compounds and were not part of the CERCLA cleanup process. Consequently, there is no entry in Table 1-1 for the 2004 to 2005 excavation activity. No change to the report is proposed from this comment.
7.	3-1	<u>Page 3-1</u> “Lastly, HHRA was revised based on BCT agreements during 2003 and 2004.” What was the BCT agreement for HHRA in 2003 and 2004?	<ul style="list-style-type: none"> Section A2.0 (HHRA Methodology) provides the details of the risk assessment that were worked out with the BCT during 2003 and 2004. The paragraph following the cited sentence refers the reader to Appendix A for details of the HHRA methodology where the specifics are described. No change to the report is proposed from this comment.
8.	4-17	<u>Page 4-17</u> , “The restricted land uses must be approved, at HPS Parcel B, by the Navy and DTSC prior to the start of construction of any buildings or structures on the listed land uses. The transferee shall request approval in accordance with the following process and criteria: ...” The burden of compliance for long-term enforcement and maintenance of institutional control appears to be shifted from the Navy to the future landowners after land transfer and a new role was created for the Navy, along with DTSC, as an enforcer for land use restrictions. It is troubling that the Navy not only left contaminations in place, and burdened the community with additional maintenance requirements without compensation; now it wants to further assert approval authority over the	<ul style="list-style-type: none"> Navy and DTSC will share in enforcement of institutional controls in accordance with the “Covenant(s) to Restrict Use of Property” and Quitclaim Deed(s). The Navy is continuing to work actively with the BCT and the City to resolve issues related to the content, implementation, enforcement, and funding of institutional controls. Appendix D will be modified to include estimates for future costs to be incurred by the Navy related to implementation of institutional controls. Please also refer to the response to City specific comment 39.

TABLE 6: DRAFT RESPONSES TO COMMENTS FROM ARC ECOLOGY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
		use of land. We have no objection to the enforcement of land use restrictions; however, any additional costs born from efforts to meet the requirements for Navy's and DTSC's approval should be paid for by the original responsible party. (The Navy should set up an account within its approval process to pay for the additional work required, such as soil management activities, new covers...etc. We feel since the Navy intends to shift the maintenance of cover to the new owners after redevelopment, the Navy should not benefit from property transfer without compensating the new owner for the future maintenance of the cover.)	
9.	4-19	<p><u>Page 4-19</u>, "... the excavation process option will be retained for only the land-based areas contaminated by lead and organic compounds (including methane source area) that present potential unacceptable risks."</p> <p>There should be clear definitions for "land-based areas" and "shoreline areas" so that areas the excavation process option is retained for can be later verified.</p>	<ul style="list-style-type: none"> Area proposed for excavation are clearly identified in Section 5.2.3. No change to the report is proposed from this comment.
10.	4-20	<p><u>Page 4-20</u>, "Existing asphalt, concrete, and building will be considered as existing covers so long as they block the exposure pathway...where covers are needed, areas shall be covered with either a minimum 4 inches of asphalt or a minimum 2 feet of imported clean soil..."</p> <p>Existing covers should also meet the minimum requirements, as do the new covers so there is a consistent parcel-wide cover.</p>	<ul style="list-style-type: none"> The text of the first bullet in this discussion of containment will be expanded as follows. "...patched so long as the patches and seals adequately break the pathway. <i>Rehabilitation of existing covers will be designed to meet the same minimum requirements as new covers.</i>"
11.	4-20	<p><u>Page 4-20</u>, "the revetment includes two key features that allow it to isolate contaminated sediments (1) a geomembrane to prevent migration of fine-grained sediments into the bay, and (2) an erosion-control element such as riprap, gabion, articulated concrete mat, or concrete structure..."</p> <p>While the key features were presented here, the elements to be used for the revetment are still to be selected in Remedial Design (RD). It is important to prescribe a measurable performance standard for the revetment in TMSRA to guide the design and to ensure compliance with remedial action objectives.</p>	<ul style="list-style-type: none"> The central objective is prevention of migration of sediment to the bay. The conceptual development of the revetment in the TMSRA is sufficient for evaluation as a remediation alternative. Detailed design calculations, specifications, and drawings to describe the structure or system to achieve the objective are beyond the scope of the evaluations in the TMSRA and will be completed during the remedial design. No change to the report is proposed from this comment.

TABLE 6: DRAFT RESPONSES TO COMMENTS FROM ARC ECOLOGY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
12.	4-20	<p>Page 4-20, “Shoreline enhancement was eliminated from consideration based on the difficulty installing a geomembrane along the IR-26 shoreline, where a large amount of riprap already exists. The geomembrane cannot be installed over the existing riprap. The process involved removing the existing riprap and then installing geomembrane is not significantly different from the shoreline revetment option...”</p> <p>It is confusing as to what is considered to be shoreline enhancement. We agree it is not practical to install geomembrane over the existing riprap. As long as the same revetment option is installed on the entire shoreline along IR-07/18 and IR-26, it would provide a consistent approach for shoreline revetment.</p>	<ul style="list-style-type: none"> The revetment will be constructed along the entire shoreline of IR-07 and IR-26 at Parcel B. Shoreline enhancement was considered early in the evaluation process as a potential option that could more directly use the existing rip rap at IR-26 and, potentially, be less expensive. However, further evaluation indicated the necessity of the geomembrane to the success of the remediation and this caused shoreline protection to be eliminated from further consideration because the geomembrane cannot be installed over rip rap. No change to the report is proposed from this comment.
13.	5-1	<p>Page 5-1, “The Navy’s strategy for soil remedial alternatives is to remove contaminated soil from the site by excavation and disposal wherever practical...”</p> <p>Performance standards should be developed for soil remedial alternatives. “Removal contaminated soil ... wherever practical” does not meet remedial action objectives and is subject to wide ranges of interpretation. It makes final verification of this remediation very difficult.</p>	<ul style="list-style-type: none"> Remediation goals for soil excavation are presented in Table 3-17. The discussion in Section 5.1 is intended only as an overview. No change to the report is proposed from this comment.
14.	5-3	<p>Page 5-3, Alternative S-4: “Existing covers, such as buildings and asphalt parking lots are considered adequate for this alternative. New covers are considered for construction only in areas where there are no existing covers. The need for upgrades and repairs to the existing covers will be assessed in the remedial design and implemented for this alternative as necessary.”</p> <p>The existing covers should have the same quality and provide the same protection to be considered adequate. The need for upgrades and repairs of an existing cover should be based on the same minimum requirements for new covers.</p>	<ul style="list-style-type: none"> Please refer to the response to Arc Ecology specific comment 10.

TABLE 6: DRAFT RESPONSES TO COMMENTS FROM ARC ECOLOGY ON THE DRAFT PARCEL B TECHNICAL MEMORANDUM IN SUPPORT OF A RECORD OF DECISION AMENDMENT, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA (CONTINUED)

No.	Page	Comment	Response
15.	5-6	<p>Page 5-6, “the extent of elevated concentration of methane will be delineated to identify the methane source material.”</p> <p>It is assumed that the delineation of methane source material will be done prior to the excavation instead of “investigation by excavation” method employed during last ROD. The criteria to determine the end point of delineation should be specified here to reach a consensus among stakeholders.</p>	<ul style="list-style-type: none"> Delineation of the source area will precede excavation. Delineation would occur to the remediation goal for methane, that is, 5 percent methane by volume in air. The text of Section 5.3.2 will be revised as follows. “The extent of the elevated concentrations of methane will be delineated <i>to the remediation goal for methane (5 percent by volume in air)</i> to identify the methane source material.” Follow-up: The Navy has changed the remediation goal for methane to 1.25 percent by volume in air.
16.	5-7	<p><u>Page 5-7, New Covers</u></p> <p>There should be a warning marker put in place prior to lay down the new cover. It provides a warning to the future users before they disturb the underlying contaminated soils. Generally a bright orange color cyclone fencing material or any type of plastic mesh will suffice.</p>	<ul style="list-style-type: none"> Identification of covers using the method described may not be practical considering the large amount of future disturbance that is likely to occur during redevelopment. Detailed, highly accurate maps using instruments based on the global positioning system or conventional land surveying techniques should be adequate to record the locations of covers and reestablish those locations if redevelopment activities change the land surface. No change to the report is proposed from this comment.

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ATTACHMENT 1

Updates to the TMSRA executive summary, Section 1.0, and Section 6.0. Throughout this attachment, *italicized* text represents proposed additions to the TMSRA and ~~strikeout~~ text indicates locations of proposed deletions.

[Start of executive summary update. Following are revisions to sections of the executive summary]

PURPOSE AND BACKGROUND OF TMSRA

Environmental activities at Parcel B were conducted under...and post-construction reporting. Parcel B has completed the steps through post-construction reporting (including the five-year review); however, information about the site that became available during the remedial action indicates that modifications to the selected soil and groundwater remedies should be considered. *Updated information includes items such as the ubiquitous nature of metals in soil across Parcel B, the presence of methane and mercury, the findings of the SLERA, changes in toxicity criteria, and findings from removal actions to address radiological contaminants. The five-year review (Tetra Tech 2003b) concluded that the remedy selected in the ROD (Navy 1997) needs to be modified to be protective in the long term. The BCT has extended the schedule of CERCLA activities (contained in the FFA) to evaluate potential modifications to the Parcel B remedy and support the preparation of this TMSRA.*

A ROD amendment will be proposed for Parcel B by the Navy if the Navy determines that proposed changes to the selected remedy based upon the evaluations in the TMSRA will “fundamentally alter the basic features of the selected remedy with respect to scope, performance, or cost” as described in the NCP at 40 CFR 300.435(c)(2)(ii). For example, the consideration of parcel-wide covers to address soil contamination instead of excavation may represent a fundamental change in the scope of the remedy. For groundwater, addition of active groundwater treatment methodologies to the remedy may be a fundamental change in the scope.

The updated information *mentioned above* ~~about the ubiquitous nature of certain chemicals in soil, the need to update certain cleanup levels, and the more comprehensive understanding of groundwater, together with the currently planned land use, indicate the need to revise the conceptual site model, evaluate support~~ additional remedial actions, and *evaluate* amending the ROD. This TMSRA provides the support for the decisions *regarding remediation alternatives in an updated proposed plan and ROD amendment that will come later*, in the same way that the FS supported the initial proposed plan and ROD. The TMSRA provides a practical path forward to *evaluate* ~~undertake~~ additional remedial actions that will support parcel transfer.

[No substantial changes to following sections “Hunters Point Shipyard Background” and “Parcel B History and Setting”]

PARCEL B REMEDIAL AND REGULATORY ACTIVITIES SINCE THE 1997 RECORD OF DECISION

The Navy has conducted a number of remedial and removal actions since the ROD was signed in October 1997 (see adjacent box). These actions reduced or eliminated certain risks to human health and ecological receptors at Parcel B. The Navy prepared two explanations of significant differences that modified the remedy for soil in the ROD: one in 1998 that changed the maximum excavation depth to 10 feet, and one in 2000 that updated cleanup goals for soil. The Navy now has a better understanding of site conditions gained during the remedial actions that indicates additional remedies for protection of human health and the environment ~~may be appropriate~~ *should be evaluated and that the ROD should be amended. The five-year review (Tetra Tech 2003b) concluded that the remedy selected in the ROD (Navy 1997) should be modified to be protective in the long term. The BCT has extended the schedule of CERCLA activities (contained in the FFA) to incorporate modifications to the Parcel B remedy and support the preparation of this TMSRA.*

Specifically, the excavation and off-site disposal remedy selected in the ROD would not be protective in the long term as it was originally envisioned because the conceptual site model that formed the basis for the remedy was incomplete. The discrete release of chemicals, known as the "spill" model, was the basis for the remedial action selected in the ROD. Although this conceptual model worked well at many areas of Parcel B, the spill model did not account for all areas where chemical concentrations exceeded cleanup goals. A group of metals related to the bedrock fill quarried to build HPS in the 1940s consistently exceeded cleanup goals across Parcel B. These metals are naturally occurring in the local HPS bedrock and were distributed throughout all parcels, including Parcel B, as HPS was built. The resulting distribution of metals concentrations in soil is nearly random across the parcel and the spill model for release does not apply.

In addition to identifying the ubiquitous nature of several metals in the bedrock fill, sampling and excavation during the remedial action found that the areas at IR-07 and IR-18 contained fill that contained a high proportion of demolition debris. The highly nonuniform distribution of chemicals within the debris fill also did not conform to the spill model and, consequently, excavations in this area often greatly exceeded their originally planned extents. Furthermore, methane was detected in soil gas at a small area of the debris fill at IR-07. In addition, radiological contamination is present at Parcel B that was not known during preparation of the ROD. The debris fill, methane, and radiological contamination created additional needs to update the conceptual site model.

Updates to the risk assessment methodology and the associated risk estimates are also needed. *The toxicity characteristics of VOCs have been updated since the ROD was prepared. VOCs are now considered much more toxic via the inhalation pathway than when the ROD was prepared. Consequently, intrusion of VOC vapors into buildings is considered a more significant human health risk. The risk assessment also needs to be updated to incorporate new information available from the more than 6 years of groundwater monitoring data gathered at Parcel B, including the detection of chromium VI and mercury in groundwater. This TMSRA report includes an update to the conceptual site model for soil and groundwater, a revised HHRA, and a*

SLERA and, based on these updates, reevaluates remedial alternatives *addressing the nine criteria described in the NCP at 40 CFR 300.430(e)(9)(iii).*

UPDATED RISK EVALUATION SUMMARY

The HHRA presented in this TMSRA report revises the previous HHRA's...Lastly, the HHRA was revised based on Base Realignment and Closure Cleanup Team agreements during 2003 and 2004.

The HHRA in the TMSRA addresses chemicals that are not radioactive. Potential radiological contamination will be addressed in a radiological addendum to the TMSRA. Both chemical and radiological contaminants will then be addressed together in the proposed plan. A radiological addendum to the TMSRA is being prepared to evaluate remediation alternatives for the radiological contamination.

The HHRA estimated cancer risks and noncancer hazards... [End of executive summary update]

[Start of Section 1.0 update]

1.1 PARCEL B CERCLA PROGRESS

EPA guidance describes the CERCLA remedial process...Table 1-1 summarizes the CERCLA-related activities conducted at Parcel B. Parcel B has completed the steps through post-construction reporting (including the five-year review); however, information about the site that became available during the remedial action indicates that modifications to the selected soil and groundwater remedies should be considered. *The five-year review (Tetra Tech 2003b) concluded that the remedy selected in the ROD (Navy 1997) should be modified to be protective in the long term. The BCT has extended the schedule of CERCLA activities (contained in the FFA) to incorporate modifications to the Parcel B remedy and support the preparation of this TMSRA.*

A ROD amendment will be proposed for Parcel B by the Navy if the Navy determines that proposed changes to the selected remedy based upon the evaluations in the TMSRA will "fundamentally alter the basic features of the selected remedy with respect to scope, performance, or cost" as described in the NCP at 40 CFR 300.435(c)(2)(ii). For example, the consideration of parcel-wide covers to address soil contamination instead of excavation may represent a fundamental change in the scope of the remedy. For groundwater, addition of active groundwater treatment methodologies to the remedy may be a fundamental change in the scope.

The updated information about the ubiquitous nature of certain ~~chemicals~~ metals in soil, the presence of methane and radiological contamination, the need to update certain cleanup levels, and the more comprehensive understanding of groundwater, together with the currently planned land use, indicate the need to revise the conceptual site model, evaluate ~~support~~ additional remedial actions, and *evaluate* amending the ROD. This TMSRA provides the support for the decisions regarding remediation alternatives in an updated proposed plan and ROD amendment

that will come later, in the same way that the FS supported the initial proposed plan and ROD. The TMSRA provides a practical path forward to ~~evaluate~~ ~~undertake~~ additional remedial actions that will support parcel transfer.

This document addresses ~~CERCLA-regulated~~ chemicals *that are not radioactive*. Potential radiological contamination will be addressed in a radiological addendum to the TMSRA. Both chemical and radiological contaminants will then be addressed together in the proposed plan and the ROD amendment.

1.2 NEED FOR REEVALUATION OF CURRENT REMEDY

The five-year review (Tetra Tech 2003b) concluded that the remedy selected in the ROD (Navy 1997) should be modified to be protective in the long term. This section describes the rationale for reevaluating the current remedy based on the updated information gained at the site and necessary revisions to the conceptual site model (see Section 2.2 for discussion of the conceptual site model). Updated information includes items such as the ubiquitous nature of metals in soil across Parcel B, the presence of methane and mercury, the findings of the SLERA, changes in toxicity criteria, and findings from removal actions to address radiological contaminants.

1.2.1 Soil

The discrete release of chemicals, known as the “spill” model, was the basis for the remedial action selected in the ROD. Under this conceptual model, high chemical concentrations occur near the center of the release and concentrations decrease outward. The delineation process used in the remedial action followed this model: successive “step-out” samples were collected from release areas identified by the remedial investigation to define the extent of the release outward until all samples contained concentrations that were less than the ROD cleanup goals. The spill model for chemical releases was appropriate for many areas at Parcel B. The Navy successfully delineated and removed all contaminants above cleanup goals at 93 of 106 excavations implemented for the remedial action. The ubiquitous distribution of metals in soil, especially manganese, led to reevaluation of the remedy at the remaining 13 excavations at Parcel B.

The significant additional information gained from the sampling and excavation during the remedial action indicated that the spill model did not account for all areas where chemical concentrations exceeded cleanup goals. The Navy recognized that the spill model needed to be supplemented to account for these other areas. A group of seven metals, especially arsenic and manganese, consistently exceeded cleanup goals at locations across Parcel B. The widespread distribution of this group of metals in soil at Parcel B (that is, their ubiquitous nature) is related to the occurrence of these metals in the local bedrock that was quarried for fill during the expansion of HPS in the 1940s. These metals occur naturally in the Franciscan Formation bedrock (especially in the serpentinite, chert, and basalt rock types) and were distributed throughout all parcels, including Parcel B, as HPS was built. Although it is possible that some releases of these metals could have occurred from Navy activities, the range of concentrations of these metals at Parcel B is consistent with the range of concentrations in local bedrock. The

resulting distribution of metals concentrations in soil is nearly random across the parcel, and the spill model for release does not apply. However, the concentrations of metals in the bedrock fill sometimes exceed the ROD cleanup goals, and this fact is the primary reason that the "step-out" delineation process was not successful everywhere on Parcel B. Application of the spill conceptual model to the ubiquitous metals would result in the excavation of most of the bedrock fill at Parcel B to a depth of 10 feet below ground surface (the depth required by the ROD). Therefore, the Navy recognized the need to supplement the conceptual model to account for the ubiquitous distribution of metals in soil. Remedial alternatives in the TMSRA address ubiquitous metals using options such as containment beneath covers and institutional controls.

In addition to identifying the ubiquitous nature of several metals in the bedrock fill, sampling and excavation during the remedial action found that the areas at IR-07 and IR-18 contained fill that contained a high proportion of demolition debris. The highly nonuniform distribution of chemicals within the debris fill also did not conform to the spill model and, consequently, excavations at IR-07 and IR-18 often greatly exceeded their originally planned extents. Furthermore, methane was detected in soil gas at a small area of the debris fill at IR-07 (see Section 5.0 and Figure 5-5 for more discussion of methane). In addition, radiological contamination is present at Parcel B that was not known during preparation of the ROD. The debris fill, methane, and radiological contamination created additional needs to update the conceptual site model and the TMSRA considers remediation alternatives to address this new understanding of site conditions.

Comparison of the remedial action envisioned in the ROD to the actions completed to date illustrates the large difference between the planned and actual site conditions at Parcel B. The estimate in the ROD for the remedial action included removal of 38,000 cubic yards of soil over a period of 3 to 6 months at a cost of \$11.2 million. The remedial action at Parcel B removed over 100,000 cubic yards of soil over an active excavation period of 31 months at a cost of more than \$40 million. Figure 1-4 presents a comparison of the excavation areas estimated in the ROD to the actual remedial action excavations.

A reevaluation of the remedy selected in the ROD in light of the updated site information underscores the need to amend the ROD. The selected remedy would not be protective of human health and the environment based on the updated information about the site and revisions to human health toxicity criteria. The following bullets summarize the reevaluation of the original remedy against the two threshold and five balancing remedy selection criteria listed in the NCP at 40 CFR 300.430(e)(9)(iii). Section 6.0 presents a more detailed discussion, including a comparison of the original remedy to other alternatives developed in the TMSRA.

Current Soil Remedy

- *Protectiveness – the original ROD alternative did not consider excavation below 10 feet bgs and it is likely that deeper excavation would be necessary to remove the source of methane at IR-07. The original ROD alternative also did not account for radiological contamination. Therefore, the rating for the original ROD alternative for overall protection of human health and the environment would be not protective based on the methane source remaining in place and radiological contamination.*
- *Compliance with ARARs – concentrations of methane in soil gas exceed allowable levels identified in chemical-specific ARARs; the current remedy would not meet the ARARs identified in the TMSRA.*
- *Long-term effectiveness – the current remedy would rank as poor based on the methane source remaining in place.*
- *Reduction of toxicity, mobility, and volume through treatment – excavation does not involve treatment and the current remedy would rank poor to begin with on this criterion and would still rank as poor based on updated information about the site.*
- *Short-term effectiveness – the current remedy would rank poor on this criterion based on the much longer time needed for implementation (more than 31 months to date versus 3 to 6 months) and the subsequent much longer exposure to workers and the community; the current remedy would not achieve the remedial action objectives unless much of the bedrock fill and the debris fill area were removed, resulting in more exposure to workers and the community.*
- *Implementability – the current remedy would rank as poor based on the large scale operation to remove bedrock fill and the debris fill area.*
- *Cost – the current remedy would rank as poor based on the significantly higher cost required (more than \$40 million to date versus \$11.2 million). Cost for full implementation would likely total more than \$100 million.*

Overall, the reevaluation of the current remedy would result in a determination of “not protective” based on protectiveness and compliance with ARARs.

In summary, the excavation and off-site disposal remedy for soil, as described in the ROD, would not be protective in the long term. Knowledge that the Navy has gained during the remedial action shows the need to (1) supplement the conceptual model to include the random distribution of ubiquitous metals in soil, account for methane, radiological contamination, and the debris fill area at IR-07 and IR-18, (2) evaluate amending the ROD, and (3) evaluate additional remedial actions for soil at Parcel B. This TMSRA evaluates potential modifications to the remedy for soil in accordance with revisions to the conceptual model to support additional remedial actions that will address remaining risks.

1.2.2

Groundwater

The remedy selected in the ROD for groundwater included lining storm drains, removing steam and fuel lines, restricting use of groundwater, and groundwater monitoring. However, the remedy selected for groundwater in the ROD should be revised based on (1) the large amount of new information available from the more than 6 years of groundwater monitoring data gathered at Parcel B, including the detection of chromium VI and mercury in groundwater, and (2) changes in the toxicity estimates and exposure assumptions for VOCs since the ROD was prepared. The toxicity characteristics of VOCs have been updated since the ROD was prepared. VOCs are now considered much more toxic via the inhalation pathway than when the ROD was prepared. Consequently, intrusion of VOC vapors into buildings is a more significant human health risk. In particular, the groundwater remedy in the ROD did not identify the VOC plume at IR-10 as requiring remediation, but this plume would now pose a much greater risk than estimated in the ROD. The ROD does not contain any active remediation options to address the cleanup of VOCs in groundwater.

The Navy has investigated the area of IR-10 in considerable detail since the ROD. The Navy installed more than 25 new groundwater monitoring wells in the area of IR-10 and conducted treatability studies to investigate methods to clean up the soil and groundwater. Treatability studies using soil vapor extraction (SVE) to remove VOCs from the unsaturated zone and injection of zero-valent iron (ZVI) to destroy VOCs in groundwater were successfully implemented at the IR-10 VOC plume. The TMSRA considers these and other remediation options to address the potential inhalation risks caused by VOCs that remain in soil and groundwater at IR-10.

Similar to the discussion above for soil, a reevaluation of the remedy selected in the ROD for groundwater against the NCP evaluation criteria underscores the need to amend the ROD. The remedy would not be protective of human health and the environment based on the updated information about the site and revisions to human health toxicity criteria and exposure assumptions. The following bullets summarize the reevaluation of the remedy against the two threshold and five balancing criteria. Section 6.0 presents a more detailed discussion, including a comparison of the original remedy to other alternatives developed in the TMSRA.

Current Groundwater Remedy

- *Protectiveness – the current remedy does not include institutional controls to limit access to buildings and the remedy would not be considered protective of VOCs in groundwater that pose an unacceptable risk from vapor intrusion into buildings.*
- *Compliance with ARARs – the current remedy would meet the ARARs identified in the TMSRA.*
- *Long-term effectiveness – the current remedy would rank as poor based on the magnitude of residual risks remaining that are caused by VOCs.*

- *Reduction of toxicity, mobility, and volume through treatment – the current remedy does not contain any treatment component and, therefore, would rank as poor for this criterion.*
- *Short-term effectiveness – the current remedy includes only groundwater monitoring and would rank as excellent based on the minimal and controllable exposure to workers during monitoring.*
- *Implementability – the current remedy would rank as excellent based on the routine nature of groundwater monitoring.*
- *Cost – the current remedy would rank as poor based on the higher cost required (about \$8 million to date versus the ROD estimate of \$3.6 million); groundwater monitoring costs would continue to be incurred into the future. Cost for full implementation would likely total more than \$10 million.*

Overall, the reevaluation of the current remedy would result in a determination of “not protective.”

In summary, the remedy for groundwater selected in the ROD needs to be expanded to account for the increased potential risk from VOCs in groundwater and provide remediation alternatives to address this risk. The TMSRA uses the large amount of new information from groundwater monitoring and treatability studies to evaluate modifications to the remedy for groundwater to support additional remedial actions that will address remaining risks.

1.2.3 Shoreline

Potential ecological risk to aquatic receptors along the shoreline of Parcel B was not evaluated in the ROD. The TMSRA contains a screening-level ecological risk assessment (SLERA) to evaluate risks to aquatic receptors and the TMSRA evaluates remediation alternatives to address these risks. The SLERA concluded that a variety of organic and inorganic chemicals in sediment along the shoreline and mercury in groundwater at IR-26 pose risk to aquatic receptors. The ROD needs to be amended to address potential ecological risks in addition to human health risks.

1.2.4 Radiological

Radiological contamination was not addressed by the ROD; however, radiological contamination is present at Parcel B. The ROD should be amended to memorialize the methods and cleanup goals for radiological contaminants that are being addressed by the basewide radiological removal action. A radiological addendum to the TMSRA is being prepared to evaluate remediation alternatives for the radiological contamination.

1.3

FUTURE LAND USE

Based on the City of San Francisco's reuse plan..." [End of Section 1.0 update]

[Start of Section 6.0 update]

6.0 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section provides a detailed analysis of each remedial alternative developed in Section 5.0. *This section also includes a detailed analysis of the remediation alternatives selected in the 1997 ROD and highlights the need to reevaluate the remedy. This information will be used...*

This section also considers the remediation alternatives selected in the 1997 ROD (Navy 1997) and how the alternatives would rank in comparison to the two threshold and five balancing NCP evaluation criteria based on the updated information about Parcel B. Updated information includes items such as the ubiquitous nature of metals in soil across Parcel B, the presence of methane and mercury, the findings of the SLERA, changes in toxicity criteria, and findings from removal actions to address radiological contaminants.

[Sections 6.1.1 through 6.1.5 describing the evaluation of Alternatives S-1 through S-5.]

6.1.6 Individual Analysis of Original ROD Soil Remediation Alternative

The original ROD remedy for soil includes (1) excavation and disposal of contaminated soil, and (2) institutional controls to prevent exposure to COCs in soils that are left in place (below the maximum excavation depth). The following evaluation considers the rating of the remedial action if it were resumed and completed according to the cleanup goals in the ROD.

6.1.6.1 Overall Protection of Human Health and the Environment: Original ROD Soil Alternative

The original ROD alternative did not consider excavation below 10 feet bgs and it is likely that deeper excavation would be necessary to remove the source of methane at IR-07. In addition, radiological contamination is present at Parcel B that was not known during preparation of the ROD. Therefore, the rating for the original ROD alternative for overall protection of human health and the environment would be not protective based on the methane source remaining in place and radiological contamination.

6.1.6.2 Compliance with ARARs: Original ROD Soil Alternative

Chemical-specific ARARs associated with this alternative would not be met based on concentrations of methane detected in soil gas and the likely depth of the methane source. Therefore, the original ROD alternative would not meet ARARs.

6.1.6.3 Long-Term Effectiveness and Permanence: Original ROD Soil Alternative

The factors evaluated under long-term effectiveness and permanence included the magnitude of residual risks and the adequacy and reliability of controls. Under the original ROD alternative, contaminated soil in excavated areas would be removed and disposed of off site. Excavation would continue until results of confirmation samples indicate remediation goals are met or until the excavation would extend to a depth of 10 feet bgs. Long-term effectiveness and permanence in areas where COCs are excavated is rated as excellent; however, excavation of most of the bedrock fill and all of the debris fill area would be required to remove all COCs. Excavation would not address the methane source because the source likely extends below 10 feet bgs. The rating for the original ROD alternative for long-term effectiveness and permanence is poor based on the methane source remaining in place.

6.1.6.4 Reduction of Toxicity, Mobility, or Volume through Treatment: Original ROD Soil Alternative

The original ROD alternative includes excavation of contaminated soil and institutional controls. However, this alternative does not include treatment that would result in the destruction, transformation, or irreversible reduction in contaminant mobility. Therefore, the rating for the original ROD alternative for reduction of toxicity, mobility, or volume through treatment is poor.

6.1.6.5 Short-Term Effectiveness: Original ROD Soil Alternative

Four factors are considered as part of the short-term effectiveness criteria and are assessed below for the original ROD alternative.

The community would be protected by implementing containment controls such as dust suppression during excavation and covers over the hauling trucks during off-site transportation.

Workers would be protected during soil excavation by implementing containment controls, such as dust suppression during excavation, stockpiling and loading trucks, and following health and safety protocols, including personal protective equipment and decontamination procedures. Institutional controls would require installing barriers, fences, and signs, and health and safety requirements and personal protective equipment protocols would be enforced to minimize worker exposure during these activities.

Construction efforts for the soil removal would involve most of the remaining areas of bedrock fill and all of the remaining debris fill and would include a very large volume of material; therefore, the adverse environmental impacts from removal and disposal would be large.

The estimated time required to implement the remaining excavation would be more than 1 year.

The rating for the original ROD alternative for short-term effectiveness is poor.

6.1.6.6 Implementability: Original ROD Soil Alternative

Implementability includes technical and administrative feasibility and the availability of required resources. The alternative is technically feasible because excavation and hauling are considered conventional and commonplace technologies. However, the large scale of the excavation operation and complexities caused by the existing infrastructure (buildings and subsurface utilities) would decrease the implementability of this alternative. The rating for the original ROD alternative for implementability is poor.

6.1.6.7 Cost: Original ROD Soil Alternative

The cost of the remedial action for soil under the ROD is about \$40 million to date (not adjusted to current dollars—the total would increase if adjusted to the same cost basis as other alternatives in the TMSRA). This cost would increase substantially for full implementation (removal of most of the remaining bedrock fill and all of the debris fill); cost for full implementation would likely total more than \$100 million. The rating for the original ROD alternative for cost is poor.

6.1.6.8 Overall Rating: Original ROD Soil Alternative

The overall rating for the original ROD soil alternative would be not protective based on (1) lack of protectiveness because the methane source and radiological contamination would remain in place and (2) lack of compliance with ARARs based on methane detections in soil gas.

6.2 COMPARISON OF SOIL REMEDIAL ALTERNATIVES

This section compares the five alternatives for soil developed in the TMSRA and the original soil remedy selected in the ROD. The discussion of each evaluation criterion generally proceeds from the alternative that best satisfies the criterion to the one that least satisfies the criterion. Table 6-2 summarizes the rating for each alternative and shows a comparison of the ratings of each alternative for the two threshold and five balancing NCP evaluation criteria.

6.2.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a threshold criterion. Protection is not measured by degree; rather, each alternative is considered as either protective or not protective. Alternatives S-2 through S-5 are protective. Alternative S-5 has excellent overall protection because it includes the most active remediation (using removal, treatment, and containment process options) that reduces potential exposure to contaminated soils. Alternatives S-2 through S-5 protect human health and the environment under the anticipated future land use of the site. Alternative S-1 does not address any risks at the site and hence does not provide any protection to human health and the environment. *The original ROD soil alternative does not address the methane source area (because it is below 10 feet bgs) and radiological*

contamination and would not be protective of human health and the environment in the long term.

6.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Compliance with ARARs is a threshold evaluation criterion. An alternative must either comply with ARARs or justification must be provided for a waiver. Alternatives S-2 through S-5 fulfill all the pertinent ARARs. Alternative S-1 *and the original ROD soil alternative* do not meet ARARs.

6.2.3 Long-Term Effectiveness and Permanence

Alternative S-5 is rated the highest because it includes treatment of VOCs using SVE plus the other effective and permanent technologies from both Alternatives S-3 and S-4. The magnitude of residual risks that would remain after remedial action would be highest for Alternative S-2, which relies on institutional controls to meet the RAOs, and lower for Alternatives S-3 (excavations), S-4 (covers), and S-5 (excavations, covers, and treatment) that reduce the toxicity and volume of contaminants. Alternatives S-2 through S-5 all provide long-term effectiveness in meeting the RAOs because they rely on continuous enforcement of institutional controls to maintain covers and access restrictions. Alternative S-3 provides long-term effectiveness and permanence for soil that contains organic compounds and lead that is excavated, but relies on access restrictions for other COCs. Alternative S-4 provides a permanent cover before development, but does not permanently remove any contamination (except for excavations in the methane and mercury source areas). *The original ROD soil alternative rates as poor based on the methane source remaining in place below 10 feet bgs and radiological contamination.* Since no action would be taken under Alternative S-1, it does not provide a long-term effective or permanent solution to the soil and sediment risks present at the site.

6.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

~~Alternative S-5 would reduce both the mobility and volume of the contaminated soil as well as treat VOCs in soil and is the only alternative that provides treatment of contaminants. As a result, Alternative S-5 is rated the highest. Alternative S-3 would reduce only the volume of contaminated soil and would rely on institutional controls to address exposure, while Alternative S-4 would reduce only the mobility through use of covers (although there would be some reduction in toxicity and volume from excavation at the methane source area). Alternative S-2 would reduce only exposure to contaminants after institutional controls are implemented. Alternatives S-2 through S-5 and the original ROD soil alternative do not include treatment that would result in the destruction, transformation, or irreversible reduction in contaminant mobility. Therefore, the overall rating for these alternatives for the reduction of toxicity, mobility, and volume through treatment is poor. Alternative S-1 has no effect on the toxicity, mobility, or volume of contaminants at the site.~~

6.2.5 Short-Term Effectiveness

Alternative S-1 has the least effect on the community, remedial workers, or the environment because it includes no actions, but will not likely ever reach the RAOs. Alternatives S-2 and S-4 introduce less risk to the community, remedial workers, or the environment because they do not include excavation, hauling, and disposal of contaminated soil. Alternatives S-3, S-5, *and the original ROD soil alternative* include removing and hauling contaminated soil that would pose potential risk to the community, remedial workers, or the environment, although this risk is considered low and mitigation measures would be implemented. *The original ROD soil alternative involves much more excavation than the other alternatives and would pose the most risk to the community, remedial workers, or the environment.*

6.2.6 Implementability

Distinction among the alternatives for implementability is minimal. All alternatives require implementation of institutional controls. Installing covers (S-4) and excavating soil (S-3, S-5, *and the original ROD soil alternative*) are standard technologies that are easy to implement. Alternative S-5 would require more coordination to implement because it employs the most technologies. *The large scale of the excavation operation and complexities caused by the existing infrastructure would decrease the implementability of the original ROD soil alternative.* Alternative S-1 does not involve remedial technologies or institutional controls and requires no implementation.

6.2.7 Cost

Alternative S-1 requires no action; therefore, no costs are associated with this alternative. Alternative S-2 is the least costly (\$5 million) because it includes only the shoreline revetment as an active remediation component before the property is transferred. Alternative S-3 is estimated to cost approximately \$7.5 million, and Alternatives S-4 and S-5 — that include the covers as a process option — are estimated to cost approximately \$8.8 million and \$9.3 million. *The cost for full implementation of the original ROD soil alternative would likely total more than \$100 million.* Estimated capital and O&M costs for each alternative are summarized in Table 6-1.

6.2.8 Overall Rating of Soil Alternatives

An overall rating was assigned to each alternative (see Table 6-2). Alternative S-5 is rated excellent overall for the two threshold and five balancing NCP evaluation criteria. Alternative S-5 is the most protective, because it includes excavation, treatment, and covers, although it has the highest cost. Alternative S-3, rated very good, is more protective than Alternative S-2 because contaminants are removed, although it is somewhat more expensive. Alternative S-4, rated very good, is considerably more expensive but is more protective than are

Alternatives S-2 or S-3 before development. Alternative S-2, rated good, is easiest to implement. *Alternative S-1 and the original ROD soil alternative are rated as not protective.*

[Sections 6.3.1 through 6.3.3 describing the evaluation of Alternatives GW-1 through GW-3]

6.3.4 Individual Analysis of Original ROD Groundwater Remediation Alternative

The original ROD remedy for groundwater includes (1) lining of storm drains to prevent infiltration of contaminated groundwater, (2) removal of steam and fuel lines, (3) institutional controls to prevent use of groundwater, and (4) groundwater monitoring for up to 30 years. The following evaluation considers the rating of the remedial action if it were completed according to the cleanup goals in the ROD.

6.3.4.1 Overall Protection of Human Health and the Environment: Original ROD Groundwater Alternative

The original ROD alternative would not provide protection to human health and the environment because it would not prevent exposure to VOC vapors that would be expected to accumulate in buildings as the result of vapor intrusion from groundwater. The original ROD alternative did not include institutional controls to limit access to buildings located over VOC plumes. Therefore, the rating for the original ROD groundwater alternative for overall protection of human health and the environment is not protective.

6.3.4.2 Compliance with ARARs: Original ROD Groundwater Alternative

No chemical-specific ARARs are pertinent to the original ROD alternative because no active treatment or removal of groundwater is proposed. The location-specific ARARs identified for activities that would affect San Francisco Bay and the coastal zone at Parcel B would be met. Action-specific ARARs for groundwater monitoring would be met by developing and employing appropriate monitoring protocols. As a result, the original ROD groundwater alternative would meet ARARs.

6.3.4.3 Long-Term Effectiveness and Permanence: Original ROD Groundwater Alternative

The factors evaluated under long-term effectiveness and permanence include the magnitude of residual risks and the adequacy and reliability of controls. Under the original ROD groundwater alternative, groundwater would be monitored, but not treated. Sources such as the VOCs at IR-10 and the mercury at IR-26 would not be addressed. The risk to ecological receptors from COCs in groundwater would not be evaluated or addressed. Consequently, risks posed by exposure to COCs in groundwater would not be mitigated. Overall, the rating for the original ROD groundwater alternative for long-term effectiveness and permanence is poor.

6.3.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment: Original ROD Groundwater Alternative

The original ROD alternative would not reduce the toxicity, mobility, or volume of contamination through active remediation. Therefore, the overall rating for the original ROD groundwater alternative for reducing the toxicity, mobility, or volume through treatment is poor.

6.3.4.5 Short-Term Effectiveness: Original ROD Groundwater Alternative

Four factors are considered as part of the short-term effectiveness criteria and are assessed below for the original ROD groundwater alternative.

The original ROD groundwater alternative would not present any new risks to the community. Minimal health risks would be posed by the long-term monitoring that would periodically extract and collect small amounts of groundwater for sampling.

No remedial action workers would be exposed to risks because no active remedy to groundwater would be applied. Minimal risk to the workers would be posed during the groundwater monitoring events, but proper personal protective equipment and health and safety protocols would minimize these risks.

No adverse environmental impacts would result from construction and implementation of the original ROD groundwater alternative because no groundwater treatment is proposed. Minimal exposure to groundwater would occur during the long-term groundwater monitoring program.

Long-term monitoring for the original ROD groundwater alternative would likely extend over 30 years, although the field activities for this monitoring occur for short periods with long intervals of inactivity.

Based on this evaluation, the rating for the original ROD groundwater alternative for short-term effectiveness is excellent.

6.3.4.6 Implementability: Original ROD Groundwater Alternative

Implementability includes technical and administrative feasibility and the availability of required resources. No construction or O&M would be required to implement the remaining groundwater monitoring under the original ROD groundwater alternative; therefore, this alternative is technically and administratively feasible. Long-term groundwater monitoring is a routine activity and requires a moderate level of commonly available resources. The overall rating for the original ROD groundwater alternative for implementability is excellent.

6.3.4.7 Cost: Original ROD Groundwater Alternative

The cost of the remedial action for groundwater under the ROD is about \$8 million to date (not adjusted to current dollars—the total would increase if adjusted to the same cost basis as other alternatives in the TMSRA). Groundwater monitoring costs would continue to be incurred into the future. Cost for full implementation would likely total more than \$10 million. The rating for the original ROD groundwater alternative for cost is poor.

6.3.4.8 Overall Rating: Original ROD Groundwater Alternative

The overall rating for the original ROD groundwater alternative would be not protective.

6.4 COMPARISON OF GROUNDWATER REMEDIAL ALTERNATIVES

This section compares the four groundwater alternatives *developed in the TMSRA and the original groundwater remedy selected in the ROD*. The discussion of each evaluation criterion generally proceeds from the alternative that best satisfies the criterion to the one that least satisfies the criterion. Table 6-2 summarizes the ratings for each alternative and shows a comparison of the ratings for each alternative for the two threshold and five balancing NCP evaluation criteria.

6.4.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is a threshold criterion. Protection is not measured by degree; rather, each alternative is considered either protective or not protective. Alternatives GW-2, GW-3A, and GW-3B are protective. Alternative GW-1 *and the original ROD groundwater alternative* are not protective. Both Alternatives GW-3A and GW-3B have the highest rating and would be protective of human health and the environment. In addition, Alternatives GW-3A and GW-3B would accelerate the contaminant degradation that would reduce the duration of implementation and potentially allow reducing some institutional controls over time. Alternative GW-2 would also be protective of human health and the environment, but would rely more on institutional controls and provides less certainty. Alternative GW-1 *and the original ROD groundwater alternative* have the lowest rating because they are not protective of human health and the environment.

6.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

Compliance with ARARs is a threshold evaluation criterion. An alternative must either comply with ARARs or grounds for a waiver must be provided. Alternatives GW-2, GW-3A, GW-3B, *and the original ROD groundwater alternative* meet ARARs. Alternative GW-1 does not meet ARARs.

6.4.3 Long-Term Effectiveness and Permanence

Alternatives GW-3A and GW-3B would provide the highest level of long-term effectiveness and permanence because VOCs would be degraded. Alternative GW-2 would provide a lower level of effectiveness and permanence because groundwater plumes would be addressed only through institutional controls and monitoring to assess the potential migration of contaminants. *The original ROD groundwater alternative would provide only groundwater monitoring and would not address sources such as the VOCs at IR-10 and the mercury at IR-26. This alternative would have a low rating for long-term effectiveness and permanence. Since no action would be taken under Alternative GW-1, it does not provide a long-term effective or permanent solution to the soil and sediment risks present at the site.*

6.4.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives GW-3A and GW-3B are rated the highest because they both reduce the toxicity and volume of the contaminants by active treatment of the VOC plume. Exposure to these contaminants would also be addressed through institutional controls and groundwater monitoring. Alternatives GW-1, GW-2, *and the original ROD groundwater alternative* would not reduce the toxicity, mobility, or volume of contaminants in the groundwater. Alternative GW-2 *and the original ROD groundwater alternative* would not reduce the toxicity or volume of contaminants *through treatment*, but would monitor the mobility of the contamination through the long-term groundwater monitoring program.

6.4.5 Short-Term Effectiveness

Alternative GW-1 has an excellent short-term effectiveness rating, as no remedial actions are conducted under this alternative. All of the alternatives scored well in terms of short-term effectiveness according to the criteria. Alternatives GW-3A and GW-3B pose a slightly greater risk through use of active *in situ* treatment compared with Alternative GW-2. Alternatives GW-2, GW-3A, GW-3B, *and the original ROD groundwater alternative* all pose a very low risk to workers during implementation of the groundwater monitoring program.

6.4.6 Implementability

Alternatives GW-1, GW-2, *and the original ROD groundwater alternative* have the highest rating and are technically the easiest to implement. Alternative GW-2 *and the original ROD groundwater alternative* would require more resources to conduct the long-term groundwater monitoring program; however, these resources are readily available. Alternatives GW-3A and GW-3B are more complex to implement because of the injection treatment; however, this treatment is a one-time injection that would reduce the resources required for groundwater monitoring as compared with Alternative GW-2 *and the original ROD groundwater alternative*. Alternative GW-3A may be easier to implement because the injected substrates are slow-release compounds that continue to degrade COCs over time. Their slow release increases the potential to react with contaminants as they disperse in the aquifer.

6.4.7 Cost

Estimated total capital costs for each alternative are summarized in Table 6-1. Alternative GW-1 is rated the highest because no cost is associated because no actions would be taken. Alternative GW-2 has a moderate cost (\$1.62 million), most of which is for the 30 years of long-term monitoring. Alternative GW-3A has a slightly higher cost (\$2.02 million). Alternative GW-3B has the highest capital cost because of the cost of the ZVI additive (\$2.35 million). *The cost for full implementation of the original ROD groundwater alternative would likely total more than \$10 million.*

6.4.8 Overall Rating of Groundwater Alternatives

Alternative GW-3A has the highest overall rating. The treatment effectively reduces risks to human health and environment and the cost is similar to Alternative GW-2 while actively treating COCs in groundwater. Alternative GW-3B ranks well also, but the higher cost makes it less advantageous. Alternative GW-2 is easy to implement, but it is not as effective as Alternatives GW-3A and GW-3B. Alternative GW-1 *and the original ROD groundwater alternative* are not protective.

6.5 SUMMARY AND CONCLUSION

This section summarizes the rationale for reevaluating the current remedy based on the updated information about the site and subsequent revisions to the conceptual site model.

6.5.1 Soil

The excavation and off-site disposal remedy selected in the ROD would not be protective in the long term as it was originally envisioned because the conceptual site model that formed the basis for the remedy was incomplete. The discrete release of chemicals, known as the “spill” model, was the basis for the remedial action selected in the ROD. Although this conceptual model worked well at many areas of Parcel B, the significant additional knowledge gained from the sampling and excavation during the remedial action indicated that the spill model did not account for all areas where chemical concentrations exceeded cleanup goals and that the conceptual site model needed to be supplemented.

A group of seven metals, especially arsenic and manganese, consistently exceeded cleanup goals at locations across Parcel B. The widespread distribution of this group of metals in soil at Parcel B (that is, their ubiquitous nature) is related to the occurrence of these metals in the local bedrock that was quarried for fill during the expansion of HPS in the 1940s. These metals occur naturally in the Franciscan Formation bedrock and were distributed throughout all parcels, including Parcel B, as HPS was built. The resulting distribution of metals concentrations in soil is nearly random across the parcel, and the spill model for release does not apply. However, the concentrations of metals in the bedrock fill sometimes exceed the ROD cleanup goals, and this fact is the primary reason that the “step-out” delineation process was not successful everywhere

on Parcel B. Application of the original ROD cleanup goals to the ubiquitous metals would result in the excavation of most of the bedrock fill at Parcel B to a depth of 10 feet bgs. Remedial alternatives in the TMSRA take into account the revised conceptual site model and address ubiquitous metals using options such as containment beneath covers and institutional controls.

In addition to identifying the ubiquitous nature of several metals in the bedrock fill, sampling and excavation during the remedial action found that the areas at IR-07 and IR-18 contained fill that contained a high proportion of demolition debris. The highly nonuniform distribution of chemicals within the debris fill also did not conform to the spill model and, consequently, excavations in this area often greatly exceeded their originally planned extents. Furthermore, methane was detected in soil gas at a small area of the debris fill at IR-07. In addition, radiological contamination is present at Parcel B that was not known during preparation of the ROD. The debris fill, methane, and radiological contamination created additional needs to update the conceptual site model and the TMSRA considers remedial alternatives to address these new conditions.

A reevaluation of the remedy selected in the ROD in light of the updated site information underscores the need to reassess remediation alternatives. The selected remedy would not be protective of human health and the environment based on the updated information about the site.

6.5.2 Groundwater

The remedy selected for groundwater in the ROD should be revised based on (1) the large amount of new information available from the more than 6 years of groundwater monitoring data gathered at Parcel B, including the detection of chromium VI and mercury in groundwater, and (2) changes in the toxicity estimates and exposure assumptions for VOCs used for risk assessment since the ROD was prepared. VOCs are now considered much more toxic via the inhalation pathway than when the ROD was prepared. Consequently, intrusion of VOC vapors into buildings is considered a more significant human health risk. In particular, the groundwater remedy in the ROD did not identify the VOC plume at IR-10 as requiring remediation, but this plume would pose a much greater risk than estimated in the ROD. The ROD does not contain any active remediation options to address the cleanup of VOCs in groundwater.

Similar to the discussion above for soil, a reevaluation of the remedy selected in the ROD for groundwater against the NCP evaluation criteria highlights the need to reassess remediation alternatives. The remedy would not be protective of human health and the environment based on the potential risk from vapor intrusion of VOCs from groundwater.

6.5.3 Shoreline

Potential ecological risk to aquatic receptors along the shoreline of Parcel B was not evaluated in the ROD. The SLERA evaluated risks to aquatic receptors and the TMSRA evaluates

remediation alternatives to address these risks. The SLERA concluded that a variety of organic and inorganic chemicals in sediment along the shoreline and mercury in groundwater at IR-26 pose risk to aquatic receptors. The ROD needs to be amended to address potential ecological risks in addition to human health risks.

6.5.4 Radiological

Radiological contamination was not addressed by the ROD; however, radiological contamination is present at Parcel B. The ROD needs to be amended to memorialize the methods and cleanup goals for radiological contaminants that are being addressed by the basewide radiological removal action. A radiological addendum to the TMSRA is being prepared to evaluate remediation alternatives for the radiological contamination.

6.5.5 CONCLUSION

The excavation and off-site disposal remedy for soil, as described in the ROD, would not be protective in the long term. Site knowledge that the Navy has gained during the remedial action shows the need to (1) supplement the conceptual model to include the random distribution of ubiquitous metals in soil, methane, radiological contamination, and debris fill areas, (2) evaluate amending the ROD, and (3) evaluate additional remedial actions for soil at Parcel B. This TMSRA evaluates modifications to the remedy for soil in accordance with revisions to the conceptual model to support additional remedial actions that will address remaining risks.

Likewise, the remedy for groundwater selected in the ROD needs to be expanded to account for the increased potential risk from VOCs and mercury in groundwater and provide remediation alternatives to address this risk. The TMSRA uses the large amount of new information from groundwater monitoring and treatability studies to evaluate modifications to the remedy for groundwater to support additional remedial actions that will address remaining risks.

The ROD did not address potential ecological risk to aquatic receptors along the shoreline. The TMSRA estimates risk and evaluates remediation alternatives to address these risks.

Finally, the ROD did not address radiological contamination. The ROD needs to be amended to memorialize the methods and cleanup goals for radiological contaminants that are being addressed by the basewide radiological removal action. A radiological addendum to the TMSRA is being prepared to evaluate remediation alternatives for the radiological contamination.

[End of Section 6.0 update]